February
1961

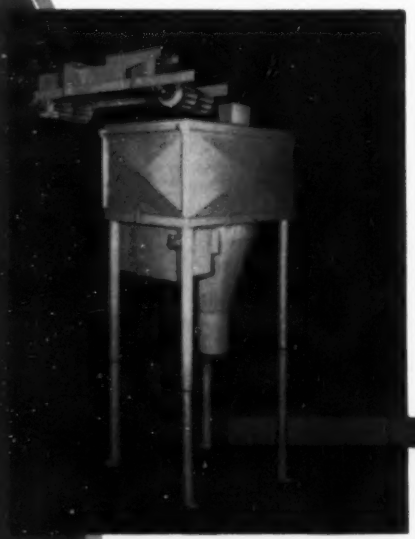
COMMERCIAL FERTILIZER

and PLANT FOOD INDUSTRY

TECHNICAL TIPS FOR BETTER AMMONIATION

SEE PAGE 19

Advertisement of NITROGEN DIVISION, ALLIED CHEMICAL CORPORATION



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Sales Service: Cyanamid sales representatives are available to work with and for you in expanding present markets or in establishing new markets.

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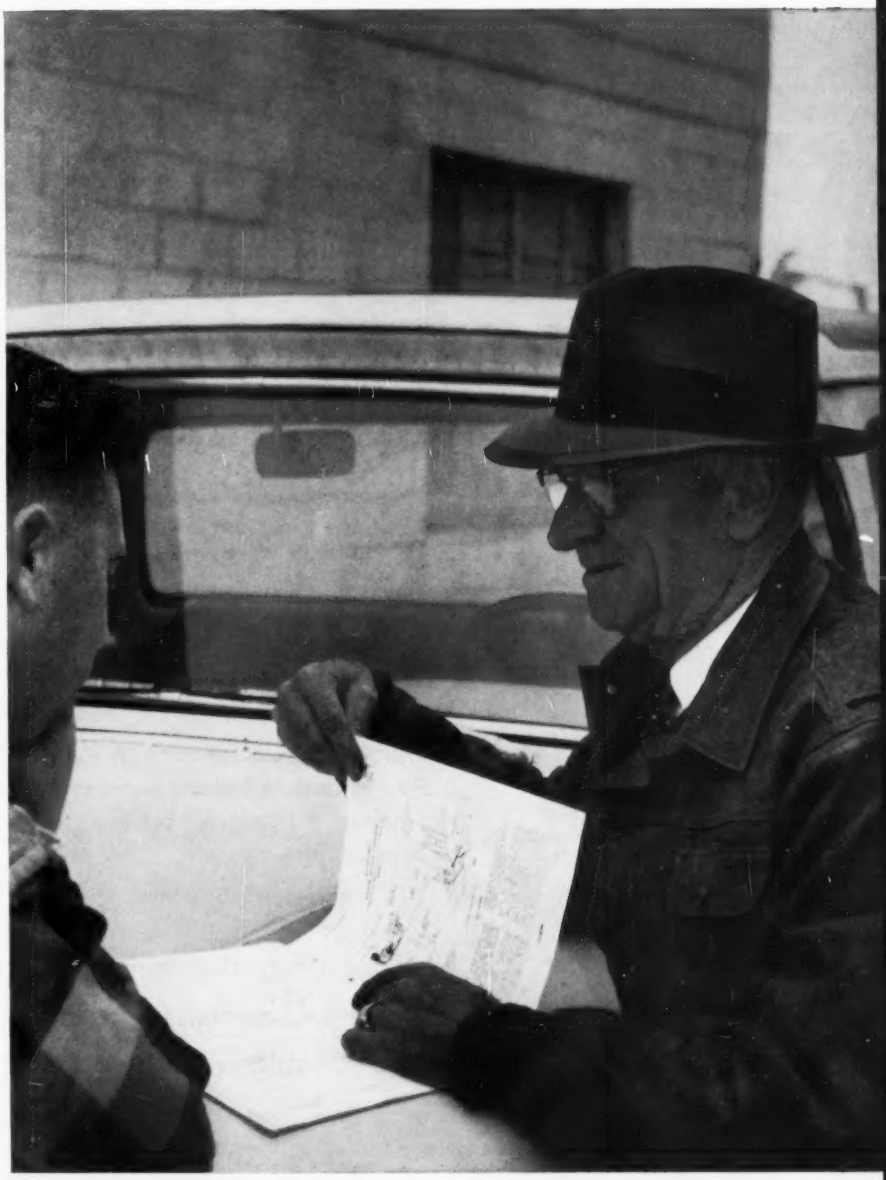
®TREBO-PHOS is American Cyanamid Company's trademark for its triple superphosphate.



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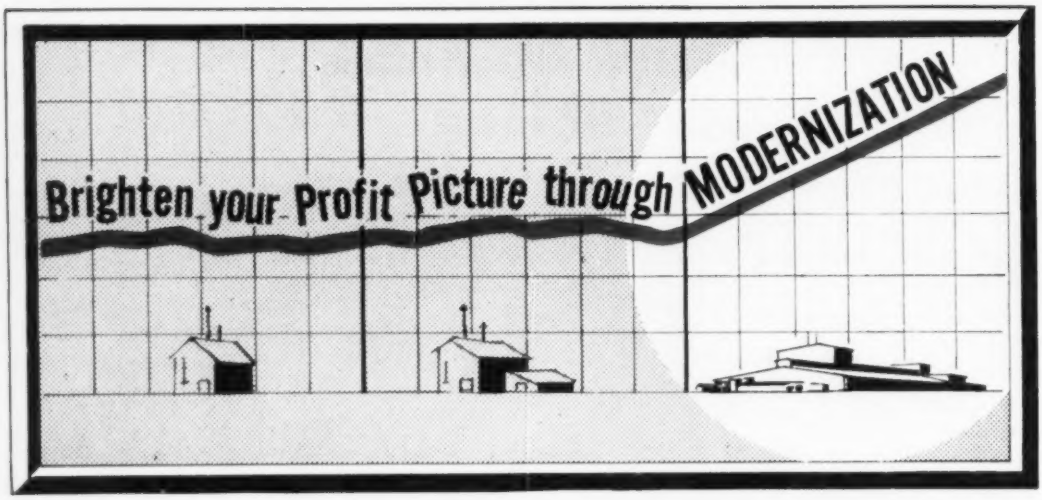

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COMMERCIAL FERTILIZER
and PLANT FOOD INDUSTRY

Vol. 102, No. 2 — February, 1961

Established 1910

COMMENTING FREELY

by

Bruce Moran

It is encouraging to note from the material that flows over the editorial desks that "new frontiers" are being breached in the fertilizer industry as well as in the National Government. It has taken a long time for some of these things to come about: aggressive selling of turf fertilizer; forest fertilization; home and garden plant foods; really high analysis.

But they are happening. Plant food societies are giving some of these preferential treatment at their educational meetings. Manufacturers are launching potent advertising campaigns. Dealers and applicators are being indoctrinated.

The results to date are not overwhelming, but we seem to be on the way at last.

More important, perhaps, than any of this is the new stress on education all down the line, based on research, on studies of local conditions, on methods of dealers. And no small victory is the rapid growth of soil testing in the past year or two. The facilities are growing up nicely with the demand.

Without a working crystal ball, we can hardly make any sort of prediction for the near future. But the long-range picture is good . . . very good.

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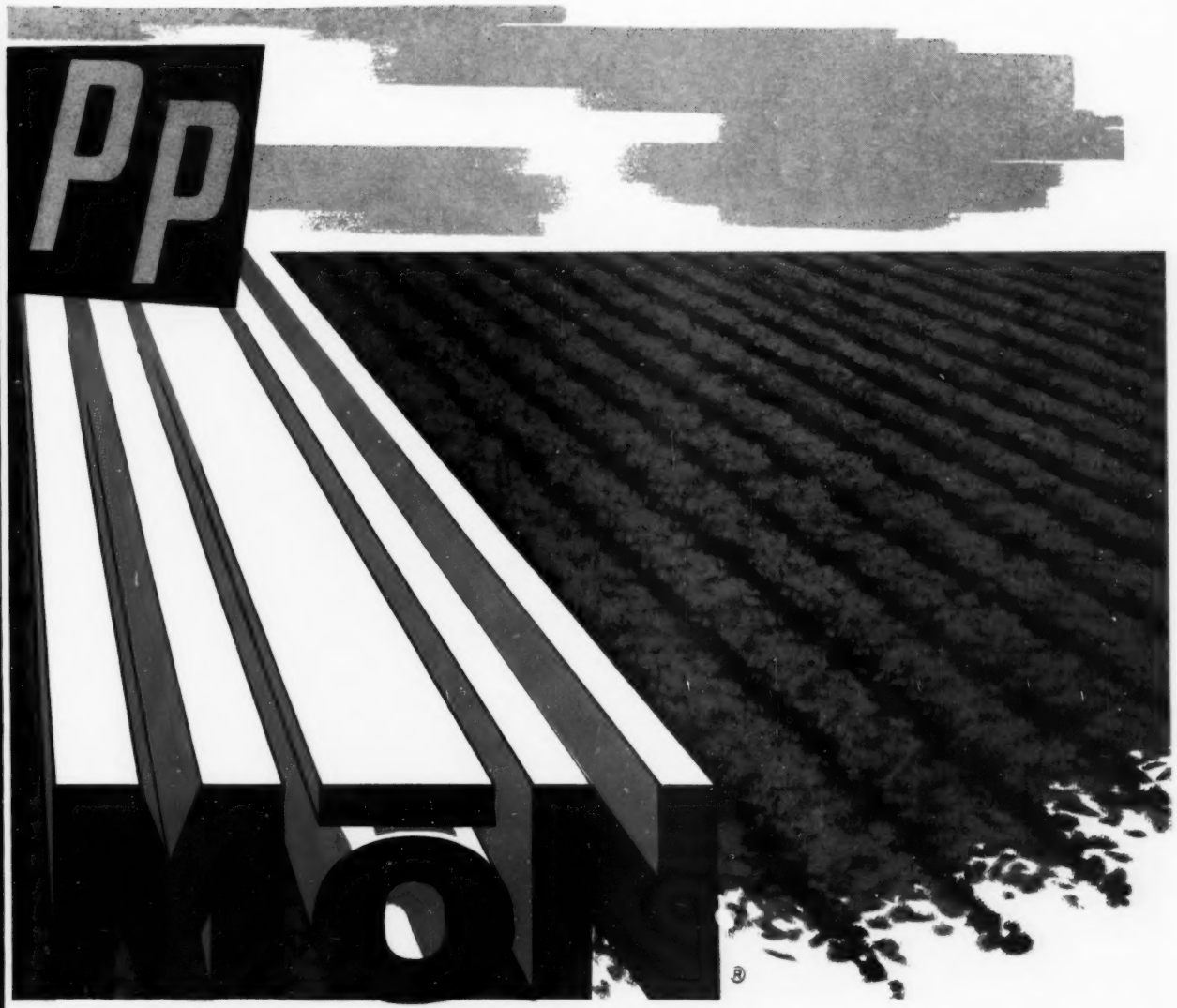

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You are cordially invited to drop by for a few puffs on the peace pipe whenever you are in the neighborhood, but at any time remember that the P.C.A. Chief's services are as close to you as your nearest tom-tom. Call New York, LT 1-1240, or TWX NY - 1 - 5386.

If you've got a problem the Chief can help you solve, he's always glad to tell you "How".

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JUST AROUND THE CORNER

By Vernon Mount

Even rockbound Republicans are cheered by the way the Kennedy Administration has taken hold. Even the greybeards feel that the energy of this youthful administration may clear up a lot of things that Ike must have been mighty glad to get away from.

Sound industry background marks the key men of JFK's selection. They know what a payroll is; what a profit should be; what radical ideas can do to business. There seems to be none of the passionate desire to reform which marked the early days of the Roosevelt administration . . . and which never really left us until 8 years ago.

So, as I said last month, the industrial community is expressing its faith by spending money for capital improvements. Coupled with current caution this indicates that there is confidence in the future – but a tendency to watch carefully the next few months for the predicted climb out of the cellar of the present recession.

Yours faithfully,

Vernon Mount

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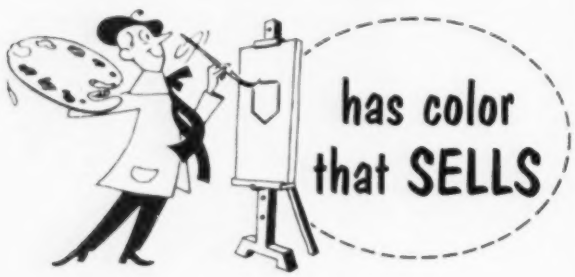
the sterilized organic conditioner



Use Fur-Ag in your mixed fertilizers and your goods take on a rich, dark color that invites sales. It reduces bag-set, speeds up curing in the pile and provides bulk. Sterilized Fur-Ag is free from plant diseases, insects, weed seeds and it's readily available all year 'round at surprisingly low cost. For full information, write for Bulletin 127.

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Phosphate Rock— Ground and Unground Triple Superphosphate

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For example, Swift's Phosphate Center includes a Customer Service facility where, through the magic of a modern, precise control system, you can get accurate, up-to-the-minute information on cars shipped, car numbers, dates and routing. Like the Minute Man, a minute's notice is all that is needed to put the system into action.

You'll enjoy doing business with Swift's Phosphate Center . . . with dedicated people who want to serve you. Have a Swift Phosphate Center Representative outline the advantages Swift's service offers you in phosphates—triple, phosphate rock or ground phosphate rock.

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THE SERVICE CENTER FOR ALL YOUR PHOSPHATE NEEDS

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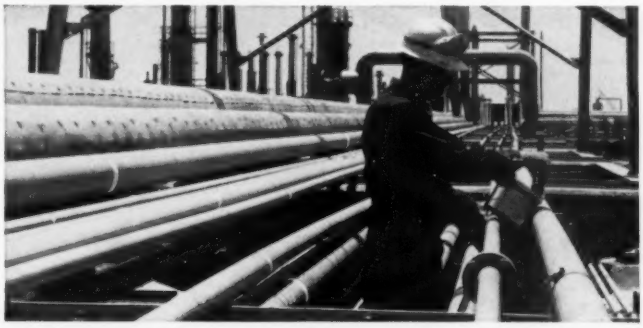
Phosphate Center • Bartow, Florida

P-5

To Serve Your Industry Better WITH MINUTE MAN PHOSPHATE ROCK, GROUND PHOSPHATE ROCK AND TRIPLE SUPERPHOSPHATE



HANDLES 32% HCl AT AMBIENT TEMPERATURES—Workman is painting a section of Fibercast Pipe bearing 32% HCl at a Shell chemical plant. Note that Fibercast has sufficient strength for installation on span racks with the spacing normally used for metal pipe.

New pipes handle temperatures and pressures where no other pipes will do

WHAT is Fibercast?

It is a centrifugally cast, thermoset, epoxy resin reinforced pipe that handles temperature and pressure problems where no other non-metallic pipe will do. Its body of woven glass fibers resists high tension forces, is imbedded and bonded by heat in epoxy resin. Result: strong, long-lasting pipe that resists high pressure and temperatures in corrosive environments.

WHERE should Fibercast be used?

The petroleum industry . . . chemical . . . petro-chemical . . . nuclear energy . . . textile . . . paper . . . and food-processing industries . . . countless operations handling acids, alkalies, salt water and other corrosive liquids under pressure.

Wherever ease of handling, lightweight, dielectric properties and structural stability are desirable in a material that is at the same time outstandingly resistant to heat, pressure and corrosion.

WHY use Fibercast?

Because its advantages of superior resistance to heat, pressure and corrosion give Fibercast long service life that would alone justify choosing it over other materials.

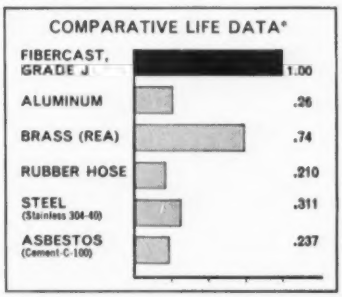
Because even more expensive metal pipe or pipe with thermoplastic interior coatings cannot match Fibercast's proven durability.

Because case histories and accurate testing have proved over and over again that Fibercast performs better, lasts longer, costs less.

Because out of 338 common corrosive solutions, Fibercast competently handles 320.

And, naturally, because Fibercast's unique and lasting qualities under such conditions mean that it drastically reduces maintenance and replacement costs, too.

Fibercast Tubing (right) used to suspend a 1,200 lb. pump for 3 years in a salt water supply well. *There was no loss in strength.* The damaged plastic-coated steel nipple (left) was used in the same installation, failed after 3 months service.



**Basing Fibercast as unit life of 1 and others as comparative percentages thereof.*

Remember, also, that the three major systems of joining all pipe are used with equal success on Fibercast (standard flanged, cemented, and threaded and coupled), and with a complete selection of Fibercast Fittings. It's the world's largest line of corrosion-resistant epoxy pipe fittings!

Get the full story on Fibercast's cost-saving advantages to industry. Learn how it can help *you* solve your pipe and tube problems. Don't wait, mail coupon today!

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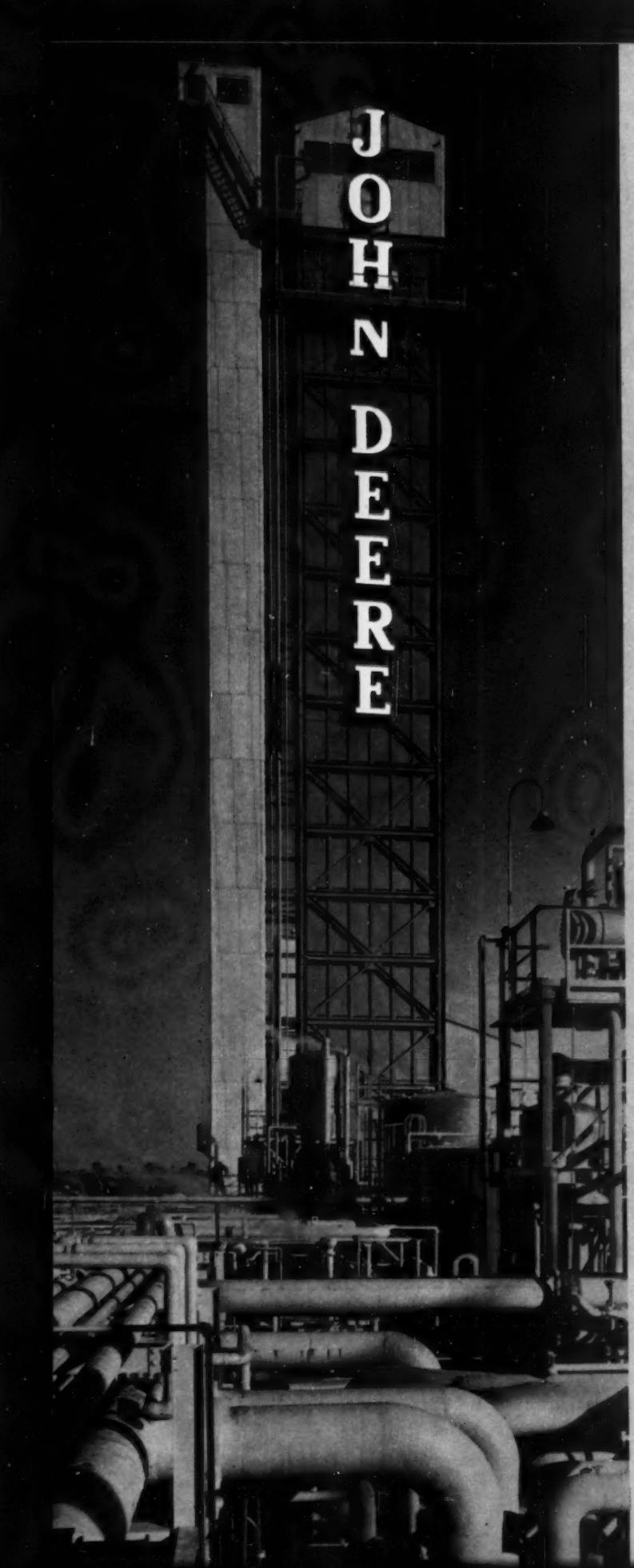

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. . . 46% fertilizer grade nitrogen . . . preferred for a concentrated nitrogen source in liquids and mixes.

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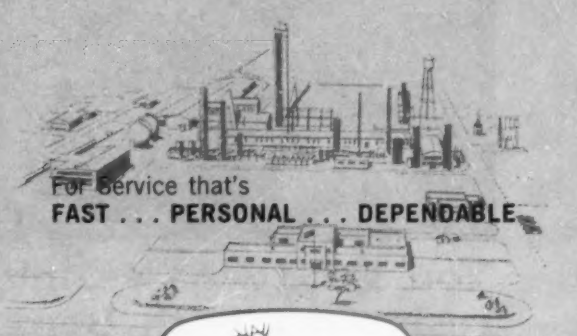
. . . economical, practical for mixed fertilizers. Non-corrosive to protect valuable equipment . . . leach resistant . . . easy mixing . . . ideal for batch or continuous mixing.



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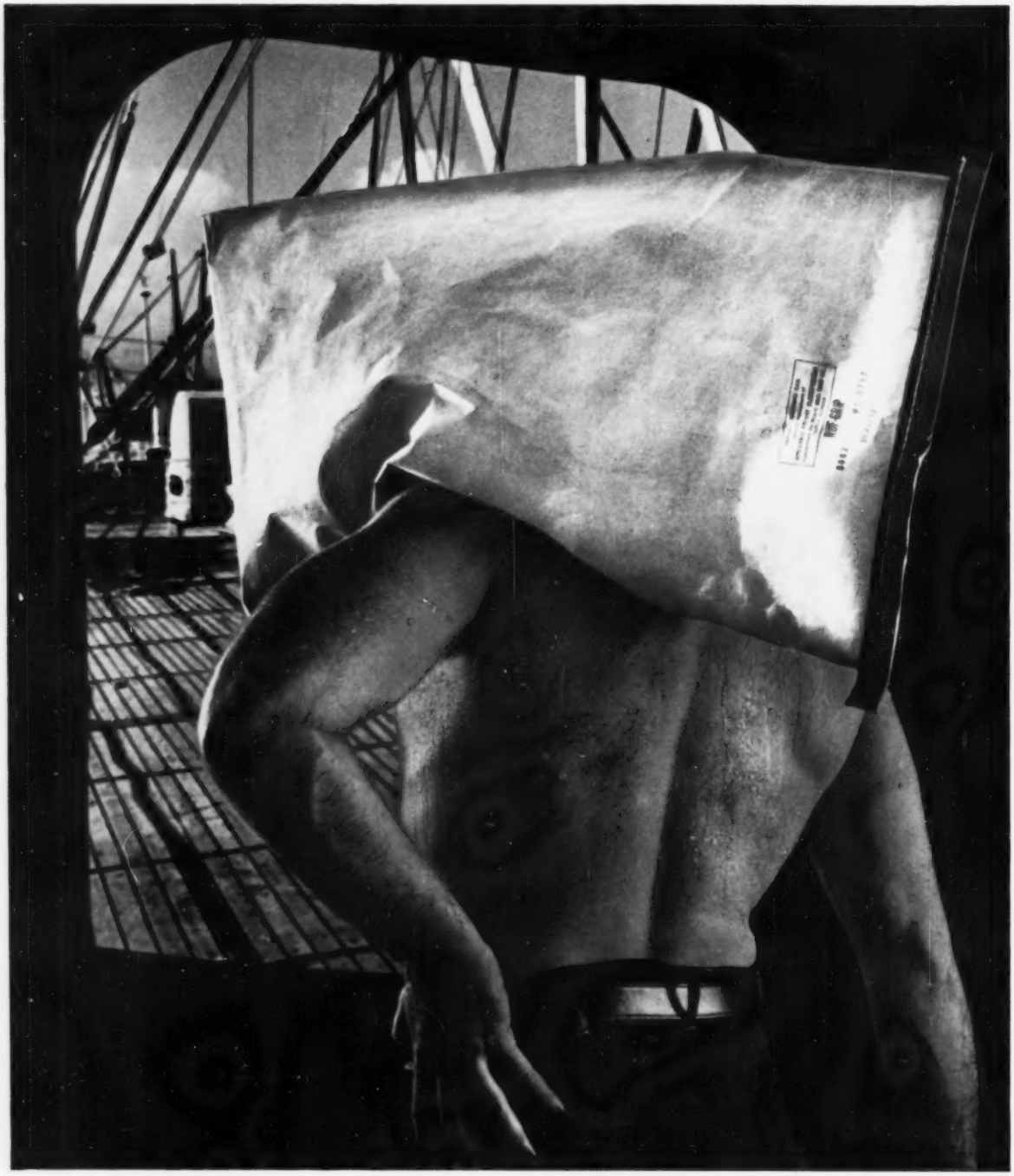

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GRACE

DAVISON CHEMICAL Agricultural Chemicals Division, Baltimore 3, Md.

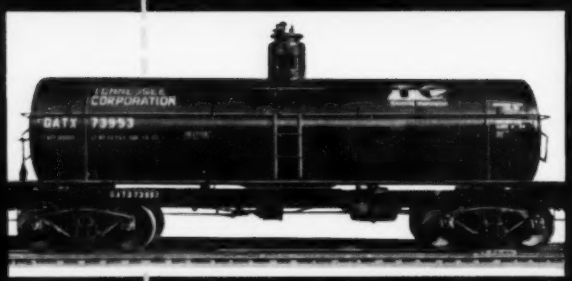
Some formulations of ratios in higher analysis grades using DAVISON 16-48-0

Ratio Analysis	Pounds of Material Required			
	16-48-0	Ammo. Sol. (21%N)	Triple (46%APA)	Potash (60%K₂O)
1-1-1 14.4-14.4-14.4	602	917		481
1-2-2 11-22-22	917	349		734
1-4-2 8.5-34-17	1063		370	567
1-4-4 6.6-26.5-26.5	828		290	882

**Other higher analysis nitrogen materials (urea and ammonium nitrate) may be substituted in above formulations.*
Analysis in the more popular ratios, such as 12-12-12, 10-20-20, 6-24-12, 5-20-20, can be manufactured by the addition of granular dolomitic limestone or other materials.

TENNESSEE CORPORATION

SULFURIC ACID



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Arcadian® News

Volume 6 | Nitrogen Division, Allied Chemical Corporation | Number 2

Precautions for Handling Solutions in Cold Weather

Nitrogen Solutions with a high content of ammonium nitrate or urea salts are an economical source of nitrogen for production of high-nitrogen mixed fertilizers. But, certain precautions are required in handling these Solutions during cold weather, due to their tendency to "salt out."

Because of the high level of dissolved salts in these Solutions, their "salting-out" temperature is higher than that of Solutions containing more free ammonia or water. It is also higher than atmospheric temperatures during winter months in some areas.

The "salting-out" temperatures for all ARCADIAN® Nitrogen Solutions are shown in the specification chart on another page of the ARCADIAN News.

These are the Solutions' temperatures at which crystals begin to form. Crystallization of nitrogen salts does not start until the temperature of the Solution actually reaches the "salting-out" or "saturation" point.

Accurate Laboratory Tests

The exact "salting-out" point of each Solution is determined in the Nitrogen Division laboratory by gradually cooling the Solution until crystals start to form. "Salted-out" samples are then warmed and dissolution points of crystals are checked against previously-determined "salting-out" temperatures, to avoid any possibility of inaccuracy due to super cooling.

Nitrogen Division technicians chill the Solution until crystals occupy much of the visible Solution space. The Solution is then warmed and its temperature at the disappearance of the last crystal is determined. The test is then repeated with very slow warming as the indicated dissolution temperature is approached.

When the "salting-out" temperature is obtained by this method, there is no possibility of salt deposition above this temperature. Slightly below this temperature, only incipient crystal formation is possible. Crystallization increases progressively as the temperature is lowered further and only at much lower temperatures will the Solution freeze solid.

Temperatures Change Slowly

Solution temperatures actually respond very slowly to changes in atmospheric temperature. Tank-car quantities of Solution must be exposed to low atmospheric temperatures for considerable periods of time before the Solution temperature will drop to atmospheric temperature.

The amount of solids that crystallize are in proportion to the temperature drop below the saturation point, and crystals dropping out of solution lower the "salting-out" point of the remaining liquid.

Openings in spray pipes and lines in the fertilizer plant are usually of sufficient size to enable Solutions carrying small amounts of crystals to flow without difficulty.

The table shows the amount of salt which will separate from two NITRANA® Solutions at various temperatures below the "salting-out" point.

In practice, Solutions are often successfully handled and tank cars are completely unloaded, when atmospheric temperatures are considerably below "salting-out" temperatures. In such cases, it is important to avoid allowing Solutions to remain stagnant in pipe lines and equipment for a prolonged period. If there is to be a delay in operation, the system should be purged immediately.

Safety First!

Explosions or fires can be caused by applying heat with flame or electricity to

(continued on following page)

APPROXIMATE POUNDS OF SOLID SALT FROM 100 POUNDS SOLUTION WHEN COOLED BELOW THE SOLUTION "SALTING-OUT" TEMPERATURE

SOLUTION	"SALTING-OUT" TEMPERATURE	DEGREES BELOW "SALTING-OUT" POINT 5°F	10°F	15°F	20°F
NITRANA 4	56°F	2 lbs.	6 lbs.	8 lbs.	10 lbs.
NITRANA 4M	61°F	2 lbs.	5 lbs.	7 lbs.	9 lbs.

(continued from preceding page)

equipment which contains nitrogen solutions or even very small amounts of residue from nitrogen solutions. If you need heat to free piping of "salted-out" blockage, the safest heat to use is hot water or low-pressure steam.

Some operators heat the compressed air that is used to move nitrogen solutions, with the belief that this will conserve heat in the storage tank. This practice is ineffective and dangerous. The air carries very little heat and most of this is lost in the small pipe line. When high heat first contacts ammonia in the presence of air, there is always the danger of an explosion. Very hot air can cause an explosion in the pipe line, in the tank and even in the air compressor.

During cold weather, ARCADIAN Nitrogen Solutions arrive at your plant in well-insulated tank cars which usually stay warm until you have used the contents, when a few simple cold weather practices are utilized. This may involve working overtime to empty the car so that it will not lose heat overnight or over the weekend. Insulating the solutions pipe line is a tremendous help in cold weather handling.

Ten Helpful Suggestions

The following suggestions will assist you in more efficient handling of NITRANA®, URANA®, and U-A-S® Solutions during cold weather:

1. When atmospheric temperatures are expected to be below "salting-out" point, do not transfer solution to storage tanks but use directly from tank car. Ammoniating Solutions are loaded hot and Nitrogen Division tank cars are well insulated.

2. Insulate pipe lines wherever practical. Use the best insulation obtainable—but even dry burlap is better than no insulation.

3. When supply pipes are cold, do not introduce solution until mixing machinery has been started and the first charge of fertilizer is actually in the mixer. Then try to keep solution moving with a minimum of delay between charges. If for any reason delay is anticipated, blow the solution out of the measuring tank and out of pipe lines. Equipment should be arranged for blowing the solution back into the tank car or the storage tank.

4. After mixing operations have stopped and lines are cleared of solution, disconnect feed lines at tank car. This will avoid the filling of the piping through any leak in the shut-off valve.

5. Keep gauge glasses and gauge glass connections warm with electric heating devices or with electric lights. Infra lamps prove quite effective.

6. It is advisable to have gauge glasses and connections of at least ¾-inch size.

7. Use shortest feed lines practicable. Eliminate unnecessary bends and constrictions. Install enough union-connections for convenient dismantling of lines for cleaning. Install tees or crosses instead of ells at bends to permit cleaning with rods or stiff wires. The branches of tees should be upward. There should be no sags or dips in the line. Provide for complete drainage.

8. Unless necessary, do not vent air from tank car until unloading is completed, since this is a cooling action.

9. Equip solution lines with water connection for cleaning. If warm water is available, use this for cleaning and also to warm up feed lines and tank car valves before introducing solution. Completely plugged lines should be opened sufficiently by rodding to permit some water to be forced through in order to speed solution of the salt.

10. Avoid leaving small amounts of nitrogen solutions in the tank car overnight. A little overtime work may help you avoid a lot of trouble.

Advantages of Bulk Fertilizers

The practice of selling bulk fertilizers to farmers is rapidly gaining in popularity. This method of handling automatically favors heavier application per acre and greater total sales. And the larger farmers who are the best fertilizer customers often prefer the bulk system for a large part of their tonnage. Where bulk service is good, many farmers use it even where the products offered in bulk are inferior to those offered in bags.

Save Time and Labor

Handling fertilizers in bulk provides definite savings in time and labor for farmer, dealer and manufacturer. Where bulk fertilizers are handled mechanically, farmers are less apt to scrimp on recommended application rates per acre.

Many bulk truck and trailer units now on the market do an excellent job of spreading fertilizer for plow-down or top-dressing. Self-unloading feed and grain wagons are being designed for the additional job of handling fertilizer. Portable bins, hauled on trucks or wagons, are being used for fertilizer as well as for crops. New fertilizer broadcasting equipment is being designed with larger hoppers, and many farmers and dealers are also improvising bulk fertilizer equipment. New planters and drills come equipped with bigger hoppers located for convenient filling from bulk as well as from bags. Hauling equipment is also being adapted for easy mechanical unloading into fertilizer hoppers on planters.

The large investment needed for specialized bulk equipment helps to discourage the part-time dealer and the in-and-out price opportunist. Dealers who have invested in fertilizer-handling equipment must concentrate on doing a better job of merchandising to protect this investment. They are more inclined to stay active every year, to develop stronger and more stable markets. The natural result is a stronger distribution system built around better service.

The need for custom application of much of the bulk fertilizer tonnage is no real handicap to bigger sales. Efficient, large-scale custom equipment enables good operators to apply fertilizer at low cost per ton. The farmer is often happy to be relieved of the job. Many a custom operator finds that his close contact with the farmer helps him do a better all-around job of sales and service.

Arcadian News for Fertilizer Manufacturers from Nitrogen Division, Allied Chemical

Flow Meters for Ammonia

To measure ammonia accurately, and to assure trouble-free operation when you use ammonia, a flow meter has to be properly designed for this specific job. Liquid ammonia is anhydrous (water-free) ammonia held at a temperature and pressure that make it a liquid instead of a gas. At 70°F, it takes 114 pounds pressure per square inch (at gauge) to keep ammonia in liquid state from boiling.

Four Major Problems

Ammonia has four characteristics that often cause trouble in flow measurement. They must all be considered in design and installation of a practical flow meter for anhydrous ammonia:

1. Ammonia has very poor, almost no, lubricating quality.
2. Ammonia is extremely corrosive to copper and its alloys such as brass.
3. The pressure of ammonia must be kept above saturation value at any given temperature of the liquid—or—the temperature must be below the saturation value at any given existing pressure.
4. Ammonia has very low, practically no electrical conductivity which makes it impractical to measure through a magnetic flow meter.

The poor lubricating value of anhydrous ammonia makes a positive displacement type meter a poor choice. Even when made of corrosion-resistant materials, the moving parts of such a meter that are in contact wear rapidly. This quickly reduces accuracy of measurement. Displacement type meters usually allow a great loss of pressure which causes flashing of the ammonia.

The velocity type flow meters with a rotating cage may show undesirable wear of the bearings, but they have low pressure loss and excellent accuracy of measurement. One design on the market has sealed bearings to reduce wear.

The old stand-by, the orifice meter, has fair to good accuracy, depending on the quality of the installation and on the differential measuring device used. Pressure loss in this kind of meter can be minimized by proper orifice and pipe design and by use of a special low differential pneumatic transmitter.

On the score of flow meter accuracy, a measurement variation of ¼ per cent or less from actual flow is considered excellent, ¼ to ½ per cent variation is very good, ½ to 1 per cent good, and 1 to 2 per cent is fair.

The biggest problem in anhydrous ammonia flow measurement is in the temperature-pressure relationship. If the natural pressure of the anhydrous ammonia is used to move it, you get partial vaporization of the liquid at each point where (1) the temperature is raised slightly, or (2) the pressure is reduced slightly, or both. The bubbles formed by the vapor disperse through the liquid, and the increased volume is measured by the meter as liquid moved. For example, a flow meter reading may show 1,000 gallons of anhydrous ammonia moved when you actually had 900 gallons of anhydrous ammonia plus 100 gallons of vapor bubbles.

One satisfactory system of measurement for ammonia has a turbine meter in a system where the ammonia is pressurized by an inert gas to a higher level than the saturation pressure of the ammonia for a temperature at which the ammonia stays liquid. In another plant, the liquid ammonia is cooled below the temperature that is normal at the actual pressure of the ammonia.

Any flow meters of suitable non-corrosive materials, designed to handle a non-lubricating fluid, can be used for liquid anhydrous ammonia if the pressure is kept above saturation value, or if the temperature is kept below saturation value.

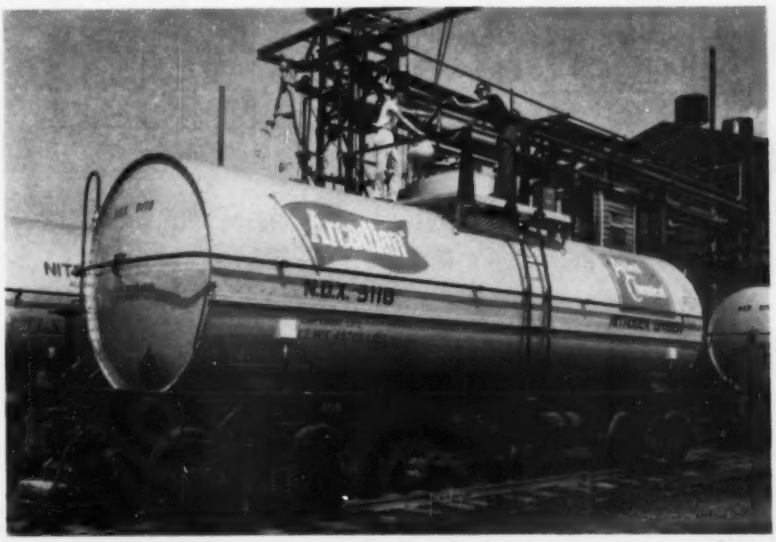
Temperature-Pressure

Use this table as a guide to maintain temperature and pressure of liquid ammonia at the proper relationship for accurate flow metering. Remember that at low temperature, the vapor pressure of anhydrous ammonia is low. At zero degrees, its vapor pressure is less than 16 pounds per square inch.

Temperature in Degrees F.	*Pressure in Pounds per Square Inch*
0	15.7
20	33.5
40	58.6
60	92.9
80	138.3
100	197.2

To add pressure: Find the saturation pressure of the ammonia at the flowing temperature. Add the maximum expected amount of pressure loss through the meter, then add an additional 20 pounds per square inch pressure.

To reduce temperature: Find the saturation temperature at the flowing pressure. Subtract enough degrees temperature to equal the expected loss through the meter and also subtract an additional 10°F.



READY TO ROLL. In addition to operating the largest fleet of tank cars in the industry, Nitrogen Division, Allied Chemical Corporation, has geared all of its facilities and operations to rapid delivery of ARCADIAN Nitrogen Solutions to help you meet production schedules. The goal is *on-time* shipment every day.

Arcadian® NITROGEN SOLUTIONS

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60° F	Approx. Vap. Press. at 104° F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
DURANA®									
DURANA contains 8% formaldehyde.	37.0	13.3	53.4	15.9	9.4	7.2	1.235	0	36
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

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Atlanta 3, Ga., 127 Peachtree St., N. E. Jackson 2-7805
Memphis 9, Tenn., 1929-B South 3rd St. Whitehall 8-2692
Indianapolis 20, Ind., 6060 College Ave. Clifford 5-5443
San Francisco 4, Cal., 235 Montgomery St. Yukon 2-6840

ALABAMA

Alabama Farmers Coop, Inc., Decatur, known until recently as Tennessee Valley Cooperatives, Inc., is planning soon to add granulation to its 30 hourly ton ammoniating plant. E. P. Garrett is general manager.

ARKANSAS

Pioneer Plant Food Inc. is expecting to be in operation by Summer with a liquid mixing plant south of DeWitt. Officers: John W. King, president; E. Thayne Muller, vice-president; F. A. O'Daniel, secretary-treasurer.

CALIFORNIA

Hercules Powder Company began operation January 23 of the newly-added plant facilities at Hercules, California. The expansion includes new manufacturing facilities for production of methanol, formaldehyde, urea-formaldehyde concentrates, and slow nitrogen release urea-form for fertilizer.

The newly completed program provides facilities for the production of 8,000,000 gallons of methanol per year, 50 million pounds of formaldehyde, and 11,000 tons of urea-formaldehyde compositions.

The methanol plant is the first on the West Coast.

The new facilities are operated by the Explosives Department of Hercules, and established the Hercules plant as one of the most diversified chemical operations on the West Coast. Other products include industrial explosives, anhydrous ammonia, nitric acid, ammonium nitrate solutions, grained ammonium nitrate, urea and urea-ammonium nitrate solutions.

* * *

Fertal-Wise Co., Norwalk, producer of small-package specialty goods, plans to add liquid fertilizer mixing and formulation of pesticides to its facilities before the end of the year. A. B. Birrell is owner.

* * *

Growers Chemical Cooperative, a new organization at Dos Palos, has been established by a group of local growers, to handle fertilizers, soil conditioners and agricultural chemicals. P. G. Biano will manage the operation.

DISTRICT OF COLUMBIA

American Liquid Fertilizer Corp., Washington, packagers of plant foods for home, garden and lawn use, have reported to us plans which, early this year, will see them with three or more plants for this purpose. Also, they state, "Our commercial custom mixing plants will be located in the Midwest, specializing with grass and pasture liquid fertilizers and plant foods, later extending this activity to grain crops."

Officers are: W. L. Stepenson, president; Charles Rudolph, vice-president; Richard Rudolph, secretary-treasurer.

FLORIDA

Tennessee Corp. division, U. S. Phosphoric Products, which is already building an $11,000,000 ammonia plant at Tampa, has now announced a 50% increase in its capacity for superphosphate, triple super, phosphoric acid and Di-MoN—a project which will run into the multi-millions. Both projects are expected to be completed and in operation at the latest by early next year.

Even before the announcement of the 50% increase in capacity, the U.S. Phosphoric plant was rated as the largest of its kind in the world.

GEORGIA

Armour & Co. has signed nine contracts to implement the Armour Agricultural Chemical $60,000,000 expansion program, previously reported here. They will triple Armour's present nitrogen and concentrated phosphate plant food materials. They include a nitrogen plant in Cherokee, Ala., a phosphate plant in Polk County, Fla.

The M. W. Kellogg Company, of New York, was awarded the contract as engineering manager of the nitrogen plant, and they will construct an ammonia plant with a capacity of 360 tons daily, a urea plant of 50 tons daily capacity, and off-site facilities. The latter include the plant offices and other service buildings.

The Chemical Construction Corporation, of New York, signed a contract to build the ammonium phosphates plant in Alabama. These high analysis plant foods will be made from ammonia made at the plant and phosphoric acid to be produced in the new Florida plant.

Chemical and Industrial Corporation, Cincinnati, contracted to build the nitric acid plant, the nitrogen solutions plant and the ammonium nitrate plant in Alabama. The plant will have a daily capacity of 240 tons of nitrogen solutions and 250 tons of ammonium nitrate prills.

The Rust Engineering Co., of Birmingham, won the engineering management contract for the Polk County phosphate plant and will also construct the office and service facilities. They were represented by S. M. Rust, Jr., president.

The Chemical Construction Corporation will build the phosphoric acid and triple superphosphate plants in Polk County.

Titlestad Corporation, of New York, was awarded the contract to produce two sulphuric acid plants for the Polk County facility.

IDAHO

Central Farmers Fertilizer Co., Georgetown, whose big electric furnace had been shut down since last November for a winterizing and repair program, was re-activated last month. Full scale production is now under way.

* * *

Bunker Hill, having settled the strike that held up production for 7½ months, is now turning out phosphoric acid in its $2,000,000 plant at Kellogg, on a seven day, around the clock schedule. All production is under contract to Collier Carbon & Chemical, as has been reported here previously.

ILLINOIS

Steve Turner Farm Seeds, Pontiac, is installing a complete liquid fertilizer plant to complement the line of bulk solid fertilizers they have been producing for a number of years.

U.S.I.'s new 7,000-ton anhydrous ammonia storage tank-inside-a-tank is nearing completion at the company's Tuscola, Illinois plant. The tank uses the relatively new technique of storing refrigerated ammonia at atmospheric pressure rather than storing it in pressurized tanks at moderate temperatures. The ammonia is maintained at a temperature of minus 28°F. by surface evaporation of the ammonia itself. The evaporated ammonia is recompressed, condensed, and recirculated to the tank.

INDIANA

Heinold Elevator Co., which operates a dry bulk blending plant at Aylesworth, is adding a liquid fertilizer plant to their facilities. Virgil Heinold is president of the firm, which has offices at Kouts.

IOWA

Ortho division of California Chemical has let contracts for its $22,000,000 fertilizer complex at Fort Madison. Ground-breaking ceremonies were held last October, followed by grading and compacting of the site, —a 419 acre tract along the Mississippi River.

There are to be four major processing units: anhydrous ammonia; nitric acid; ammonium nitrate and a fertilizer plant utilizing these elements, and producing 1000 daily tons of the various types of Ortho fertilizers, dry and liquid.

Contracts for construction of the ammonium nitrate plant and the acid plant have been awarded to the Chemical & Industrial Corporation of Cincinnati, Ohio. Plant capacities for these two units will be 150-200 tons per day for the ammonium nitrate plant and 250 tons daily for the nitric acid plant.

KENTUCKY

Hutson Chemical Co., in the solid fertilizer mixing business for a number of years, have now added a complete liquid fertilizer plant using simple dissolution process, according to Dan C. Hutson, owner and manager.

LOUISIANA

Freeport Sulphur has initiated a $23,000,000 program which will permit them to ship sulphur in liquid form, with substantial economy for users who have had to melt the sulphur on arrival. When completed early this year the new facilities will be able to handle some 1,500,000 annual long tons of sulphur,—which is more than half the company's present volume.

The program includes enlargement of their facilities at Port Sulphur, and the establishment of new terminals along the Atlantic Seaboard and on the inland waterways. Highly automatic loading facilities will be installed in the up-river terminals now being constructed at Joliet, Ill. and Wellsville, O.

MICHIGAN

Mid-State Fertilizer is building a new fertilizer plant at Shepherd on property owned by Clayton Klein of Klein Fertilizers, Fowlerville. It will be equipped with both bulk and bagged facilities, largely supplied by Burton Mixer & Mfg. Co. of St. Johns, will have a capacity of 20 hourly tons, and is in operation with James A. Parsons as manager.

MINNESOTA

Aldy Laboratories, Minneapolis, are planning expansion of their operation and a consolidation in the near future, according to A. M. Goldstein, founder and owner. The concern markets FloraDex, a liquid plant food for house plants. Additional items are being readied for market.

MISSOURI

George Willard Feed Mill and Fertilizer Service, Springfield, are building additional facilities in a new plant which will give them 1000 more tons of bulk and bag storage with complete unloading, weighing and mixing equipment.

NEBRASKA

John R. Jirdon Industries, Morrill, bulk blenders, distributor of solutions, are planning to build additional bulk blending plants this year at two new locations. John R. Jirdon is president; Don Steen is vice-president; William Siegal is manager.

Tek Annex Co., Tekamah, distributor and custom applicators of aqua ammonia, N solutions and liquid fertilizers will very likely put in their own liquid plant this year, according to president R. A. Cram.

OHIO

Richland Chemical Co., Shelby, went into production last month, according to word from Howard Arndt, president. They produce dry-mixed fertilizers, with a capacity of 15 hourly tons, and storage for 3000 tons of materials, 400 of bulk product and 500 of bagged goods. Officers, in addition to Mr. Arndt are Ruth Arndt, vice-president and Donald Clark, secretary-treasurer.

OREGON

Grow-All Inc. has been authorized to construct a plant adjacent to the Portland disposal plant and has contracted for the entire sludge and surplus gas. They will offer a dehydrated and processed fertilizer.

* * *

Dwyer Fuel Co., Portland, has named Barkdust, the wood waste on which they have been experimenting for four years. The resulting mulch will be marketed to nurserymen, landscape gardeners and home gardeners. They are producing 400 daily cubic yards. The concern is a division of Dwyer Lumber and Plywood Co.

* * *

Chemico, Inc., Albany, which operates a dry bulk fertilizer distribution center in Albany and anhydrous ammonia stations in Albany, Junction City and Waconda, will complete another bulk dry distribution outlet at Harrisburg in March. The firm does over $1,000,000 annually in fertilizers, pesticides, herbicides.

TENNESSEE

Armour Agricultural Chemical is adding granulation equipment to its plant in Nashville.

* * *

Hooker Chemical's phosphorus division, with headquarters in Jeffersonville, Ind. is on schedule installing third phosphorus furnace reported here several months ago at Columbia. This installation will increase capacity of that plant by about 50%. Other improvements are being made and added reserves of phosphate rock are being acquired.

UTAH

Texas Gulf Sulphur has awarded to Stearns-Rogers, Denver the design and construction of their $25,000,000 potash concentrating plant at Cane Creek in Grand County. This will draw upon the big deposits of pot-

ash ore in the Valley area near Dead Horse Point. It should be in operation by next year, producing about 8000 daily tons.

WASHINGTON

Thompson-Wilson Fertilizer Co. has been incorporated for $50,000 by Ralph M. Thompson, Homer B. Splawn and William L. Wilson at Toppenish.

* * *

Westates Fertilizer and Feed Inc. has been formed by Ray Paulson, C. M. Cunningham and Harrie E. Hill, at Ephrata. Capital $50,000.

* * *

Waverly Chemicals Inc. has been established in Waverly with capital of $50,000 to deal in fertilizers and engage in research. Incorporators: Kenneth C. and Patricia Hines and Rush C. Lanning.

* * *

Hooker Chemical, in conjunction with a plan to divert to the agricultural field some production from their anhydrous ammonia plant, which has heretofore gone wholly into industrial uses, are installing new agricultural ammonia facilities at their Tacoma operation.

WISCONSIN

Harvey E. Kuenn Enterprises, Inc., has established at West Allis, producing mushroom compost. Harvey E. Kuenn is president and Jack B. Jenny is production manager.

WYOMING

Prep Products, Thermopolis, are now producing a natural agricultural mineral, plan this year to produce and mix a complete organic and natural mineral fertilizer for home lawns and gardens with analysis of 5-10-5, according to the president, Robert E. Nunley.

AFRICA

Mountain and Co., Queensway, among the largest importers of fertilizers in East Africa are not liquidating, but are concentrating on the expansion of their interests in the field of fertilizers and other agricultural chemicals.

* * *

Uganda Development Corporation is building at Tororo a fertilizer plant which will employ 200 people. It should be completed in 12 months. The plant is expected to cost £400,000 and its chief product, superphosphate at the rate of 25,000 annual tons, is expected to care for 70% of the equivalent triple now being imported.

* * *

African Explosives and Chemical Industries have opened their £10,000,000 nitrogen plant in Modderfontain, with expressions of gratitude toward their overseas partners for their continued confidence in the Union of South Africa. It was stated that the plant will save £3,000,000 a year in foreign exchange, and will earn money as well, because they intend to export urea that may be over and above the needs of the Union.

CANADA

International Minerals and Chemical of Canada reports that the shaft at Esterhazy is now well into water-bearing Blairmore sands. Extraction of potash will follow on a schedule as originally set forth, they report.

DUTCH ANTILLES

Aruba Chemical Industries Ltd. has been formed to establish at Aruba a complex of chemical facilities which will include ammonia, sulphuric acid, nitric acid, urea and fertilizer. The government has agreed to guarantee a loan of $33,375,000 for development work there and in the harbor of Curacao.

ISRAELI

Negev Phosphate Co. has developed a new process which will enable phosphate ores to be enriched so as to maintain a 38% level of phosphorus content. This is to be compared with the present Israeli content of 31% and 34% high in Morocco and 28% from the Soviet sources.

ITALY

Montecatini have just opened a plant in Campofranco, Sicily, which yields sulphate of potash by an entirely mechanized process. The plant has been built there because of the kainite deposits tunneled from the hills of San Cataldo. 200,000 annual tons are the Montecatini goal for this operation. The mine is estimated to contain several score million tons.

MEXICO

Pan American Sulphur is setting up in Veracruz a Monsanto-Leonard plant of only 15 daily metric tons of 100% sulphuric acid, as a demonstration for the benefit of sulphuric acid producers, who are their customers. The operation will duplicate in miniature the normal commercial operation, and is expected to yield much data through which Pan Am can be helpful to its trade contacts.

PAKISTAN

Fenchuganj, East Pakistan's great new urea plant, was recently dedicated. When in full production, which is expected to be some time this year, the operation is expected to produce 117,000 annual tons of urea, and to free Rs 50,000,000 annually of foreign exchange. The plant was partially financed, as was a similar plant at Multan in West Pakistan, by a $10,000,000 US aid grant.

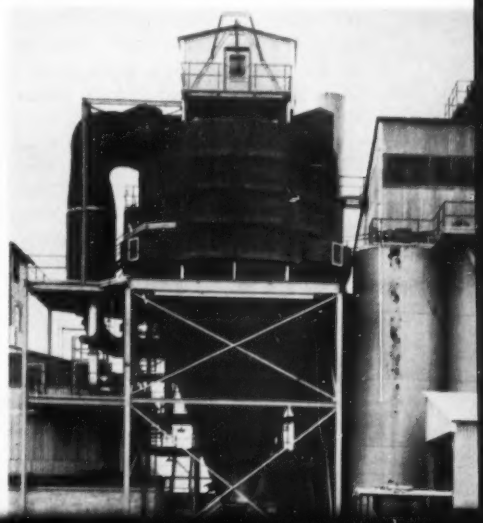
PUERTO RICO

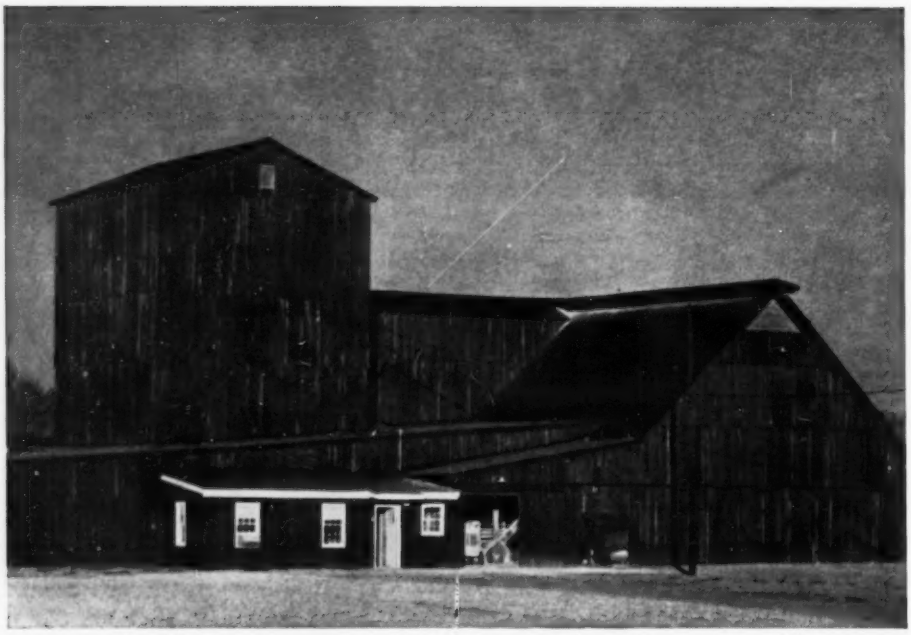
Southern Agricultural Chemicals Inc. Mercedita, who now make six types of herbicides, are contemplating formulation of some fertilizers and pesticides in the near future, according to president Felix J. Serralles.

SCOTLAND

Scottish Agricultural Industries, controlled by Imperial Chemical, is switching increasingly to compound fertilisers from ammonium phosphate. Demand has kept their new Leith works operation at full capacity last year, and they now plan to convert the Sandiland works at Aberdeen from superphosphate-based fertilisers to production of ammonium phosphate-based goods.

Bowen Engineering, Inc., North Branch, N. J., the nation's largest manufacturer of spray dryers and spray drying equipment, announces the completion of a giant 26-foot-diameter spray dryer for The American Agricultural Chemical Company. The giant dryer is now onstream at The A.A.C. Company's Carteret, N. J. facilities.





Serving a high fertilizer consumption area, Glasgow Fertilizer Company specializes in corn and tobacco blends sold under the "Big G" brand name. Read how this locally owned and operated manufacturer holds down corrosion costs with SPENSOL GREEEN*.

Weber Shipp
Vice President of Sales
Glasgow Fertilizer Company.

Rogers Wells, Jr.
Sec.-Treas. and Plant Mgr.
Glasgow Fertilizer Company.

Kentucky's New Glasgow Fertilizer Co. Becomes Big User Of SPENSOL GREEEN:

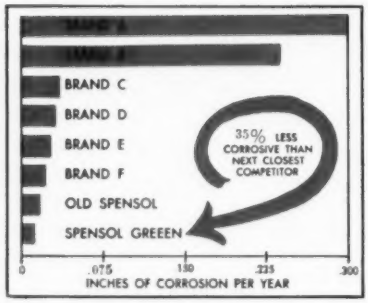
Modern fertilizer manufacturing facilities deserve the most advanced ammoniating solution. So it is no wonder that Glasgow Fertilizer Company of Glasgow, Ky., uses non-corrosive SPENSOL GREEEN in its modern plant—one of the newest in that state.

6,000 to 9,000 tons of bulk and bag goods is the first year goal of this ambitious company. With heavy production schedules to meet, any down time caused by corrosion damage would be costly. Glasgow solves this threat by controlling corrosion with genuine SPENSOL GREEEN Ammoniating Solutions.

New equipment stays new much longer when it is protected from the unseen ravages of corrosion. That's why it will pay you, too, to insist on SPENSOL GREEEN, the non-corrosive solutions. Compared to competitive brands of ammoniating solutions, SPENSOL GREEEN's advanced corrosion inhibitor proves to be at least 35% more effective!

Here are the laboratory results:

*A trademark of Spencer Chemical Company



Cut Corrosion costs at least 35% by making your next order genuine SPENSOL GREEEN! Contact your Spencer representative right away.

Insist on **SPENSOL GREEEN**

NON-CORROSIVE AMMONIATING SOLUTIONS

SPENCER®

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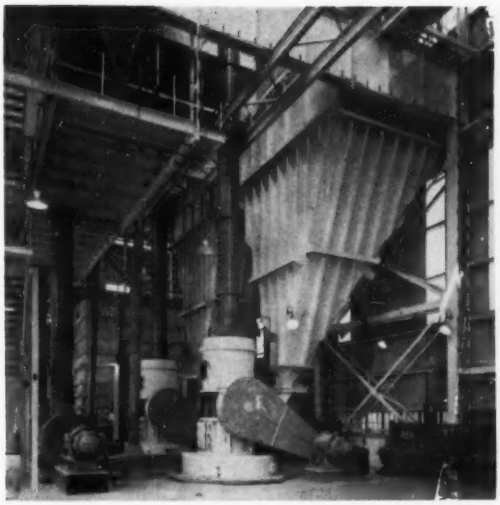
Dwight Bldg., Kansas City, Missouri

Sales Offices: Atlanta, Ga., Chicago, Ill., Memphis, Tenn., Omaha, Nebr., Kansas City, Mo.
Works: Pittsburg, Kans., Henderson, Ky., Vicksburg, Miss.

Each of the two phosphate rock grinding mils at the Fisons plant has a capacity of 20 tons hourly. A rugged hopper feeds each mill; giant fans (at left) air-sweep mills and move ground rock to screw conveyors, which carry it to storage hopper in background.



FISONS SASOLBURG PLANT

Vast quantities of fertilizer are being manufactured at the new $7 million plant of Fisons (Pty.) Ltd. near Sasolburg in the Northern Free State. The factory went into full production in June, 1959. Its annual output is now 75,000 tons of sulphuric acid, 200,000 tons of superphosphate, and 112,000 tons of granular compounds. The factory was two years building.

The plant is laid out on modern lines, and provision has been made for all sections to be extended without in any way altering the original flow plan. The latest equipment is installed, and instrumentation gives exact control of all processes, insuring consistent high quality.

Storage building for unground rock has capacity of 30,000 tons. Overhead conveyor system brings rock from rail cars offloaded outside building.

(Photographs on pages 27 and 28 by courtesy of The Shell Company of South Africa Limited.)

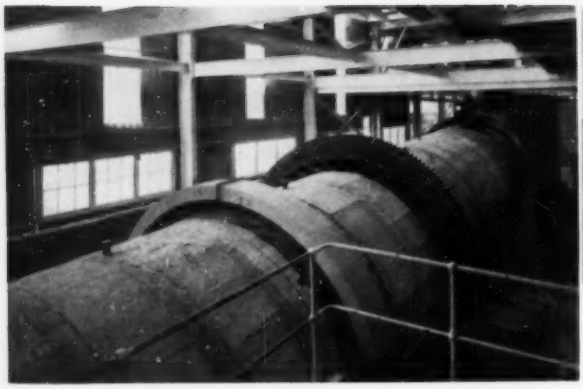
Another huge, modern storage building houses curing piles of product.

Raw materials are sulphur, rock phosphate, sulphate of ammonia and potash, which are delivered in bulk by rail and discharged through off-loading installations and carried by overhead belt conveyors to the raw material stores, where they are kept in massive bulk piles. Tractor shovels dig the materials from these piles and convey them to their points of usage. Wide internal passageways are a feature of the factory, and they permit the tractor shovels to operate efficiently and safely.

At the sulphuric acid plant sulphur is fed into a steam-heated melter and pumped to a sulphur burner. Sulphur dioxide gas is converted to sulphur trioxide by a vanadium catalyst, then combined with water to produce strong sulphuric acid. Some acid is available for sale, and that required for superphosphate manufacture is diluted with water. Waste heat produced in the acid plant is converted to steam for use in processes throughout the factory.

Rock phosphate is delivered by tractor shovel to the rock grinding plant intake system, where any loose iron is extracted by a magnetic separator. From here it passes to storage bins and two air-swept mills. The air-separated ground phosphate is delivered to a storage bin, from which it is conveyed to the Broadfield superphosphate plant or to a special packaging unit.

In the superphosphate plant, phosphate rock and sulphuric acid are weighed separately before being fed



Left: Huge dryer is pictured as insulation was applied; capacity is 45 t.p.h. at 3 r.p.m.
Above: Locomotive and tractor shovel are pictured at diesel fuel pump, with portion of sprawling plant in background. The 259 h.p. locomotive hauls eight 60-ton rail cars along plant's rail system and to siding 1¼ miles away.

into a mixer in a rock-to-acid ratio of approximately 6:5. The resulting rock/acid slurry is discharged from the mixer into the Broadfield continuous den, where it sets as the den moves towards rotary cutters, which shave the face of the solidified mass. Fine superphosphate falls on a belt conveyor which takes it to storage. After being stored for three weeks superphosphate is ready for shipment or use as a base material in mixtures.

Superphosphate for manufacturing mixtures is moved by tractor shovels to the granulating plant, where it is mixed with other materials such as sulphate of ammonia and potash.

The granulating plant produces high grade granules of consistent particle size, containing less than 1 percent water. This low moisture content insures that granular mixtures retain their free-flowing condition.

Raw materials for granulation are ground, screened and weighed prior to mixing in a rotary batch mixer, which discharges to a rotary granulator where steam or water is added to form granules that pass to a large rotary drier, heated by a coal-fired furnace.

Screening removes fines and oversize particles, which are crushed and recycled. The granular product from the screens passes through a rotary cooler. The product is carried by belt conveyors to storage. Cooled products can be packaged a few hours after manufacture.

Ocean-Going Vessel For Molten Sulphur

The S.S. Marine Sulphur Queen, an ocean-going tanker capable of hauling 15,100 tons of molten sulphur, was put into service at Baltimore late last month. It is the first ocean-going vessel in the sulphur industry to be devoted exclusively to the transport of molten sulphur.

The vessel will be operated by Marine Transport Lines under long-term contract with Texas Gulf Sulphur Company.

The Marine Sulphur Queen is a converted T-2 tanker and will be used by Texas Gulf to transport sulphur from its main storage and loading terminal at Beaumont, Texas, to two new molten sulphur terminals at Carteret, N. J. and Norfolk, Va.

The 523-foot vessel has four separate insulated cargo tanks. For sulphur to remain fluid, it must be kept at a temperature of 275°F. Tanks are steam-heated by internal pipe coils fed by two boilers producing 32,000 pounds of steam per hour. Need for constant temperatures is due to the peculiar physical characteristics of sulphur; below 240°F it begins to solidify and above 320°F it becomes viscous.

The new cargo carrier and the two new East Coast terminals represent important additions to Texas Gulf's overall program of expanding shipments of sulphur in liquid form. TGS pioneered in volume shipments of sulphur in this form, and its terminal at Cincinnati, Ohio, which opened in 1959, was the industry's first terminal for public distribution of molten sulphur.

The company estimates that by the end of this year approximately 40 per cent of its more than 2,000,000 tons of annual output will be shipped in molten form, or more than double the volume in 1960.

The Carteret terminal, operated by the Atlantic Sulphur Terminal Co., has a storage capacity of 26,000 tons, and the Elizabeth River Terminal Co. unit at Norfolk 20,000 tons. Each is equipped to make deliveries to industrial customers in the surrounding area by tank car or tank truck. The Carteret terminal will also be operating a 2,500 ton barge.

The Marine Sulphur Queen can load or discharge its cargo at the rate of 1,000 long tons per hour. Modern loading facilities at the company's main shipping port at Beaumont will enable the ship to tie up, take on a full cargo direct from adjacent TGS mines or from terminal storage and be on its way in less than 15 hours.

Fertilizer Vehicle Rentals Reach New Peak

More auto and truck fleets were leased by the fertilizer industry in 1960 than in any previous year.

New, lower-cost automotive leasing plans introduced by major leasing companies boosted the value of auto and truck fleets leased by the industry to $16.1 million. This is a gain of approximately $2.4 million over 1959. Total value of auto and truck fleets leased by all U. S. industry was $1.54 billion, a 12-month gain of $195 million.

Armund J. Schoen, president of Wheels, Inc., Chicago, a national vehicle leasing organization, said that biggest gains were registered by the truck sector of the automotive leasing industry. Firms in the fertilizer industry leased 800 trucks last year, 100 per cent more than in 1959. Auto fleets leased by the industry totaled 5,500 cars, an increase of 10 per cent.

Fishy, and Odd!

FAO is holding a special meeting in March to look into why rapidly rising production in the billion dollar fish-meal fertilizer industry is accompanied by a falling of fish-meal prices.

WHAT ARE DRI-SOL® BENEFITS IN MIXED-FERTILIZER PRODUCTION?

REDUCED SHIPPING COSTS

BETTER PROCESS CONTROL

LOWER FORMULATION COSTS

LOWER DRYING COSTS

A DRIER PRODUCT

INCREASED PLANT CAPACITY

FASTER CURING—QUICKER SHIPMENT

IMPROVED FERTILIZER QUALITY

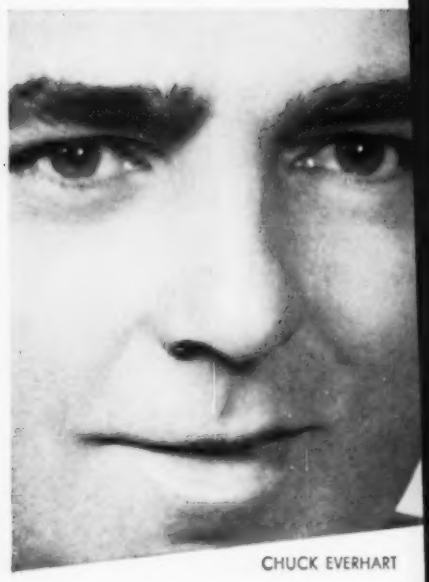
More and more fertilizer manufacturers are turning to DRI-SOL ammoniating solutions as a sure, time-tested way to lower production costs and improve mixed-fertilizer quality.

For in addition to the eight cost-saving and quality-building advantages shown above, DRI-SOL can also help manufacturers offset the high water content of low-strength acid. It also helps to produce grades which are difficult or impossible to make with conventional solutions.

What grade of DRI-SOL meets your needs best? From a wide choice of formulations you can select the solution that offers you the greatest number of advantages. Each grade contains less than 0.5% water. Grades range from 24% ammonia and 76% ammonium nitrate, to 50% ammonia and 50% ammonium nitrate, and are generally available in all the Southern and Midwestern States.

Why not get complete information? Technical data to fertilizer manufacturers available upon request. Write: Agricultural Chemicals Department, Commercial Solvents Corporation, 260 Madison Avenue, New York 16, New York. Offices also located in: Atlanta, Shreveport, St. Louis.

COMMERCIAL SOLVENTS CORPORATION CSC



CHUCK EVERHART

These men help you get the most ...from U.S.I. fertilizer raw materials

TOM MARTIN

There's nothing more impersonal than a tank car sitting on a siding. But if it's a U.S.I. shipment on your siding, you'll find there's nothing impersonal about the service behind the U.S.I. oval. One call can bring a U.S.I. Technical Service Man to your plant . . . promptly. It may be Tom Martin, for instance, or Charles (Chuck) Everhart.

Chances are you know Tom, U.S.I.'s senior field service engineer in your area. Just about every fertilizer manufacturer does, since Tom's an oldtimer in the business... was a fertilizer plant manager himself. Tom knows our products . . . knows your products as well . . . combines this knowledge to your benefit.

Chuck is a long-time fertilizer man too . . . was also a fertilizer plant manager before coming to U.S.I. Chuck is an outgoing guy who likes people, likes working with them on their problems. And there are few problems in the fertilizer field he hasn't tackled at some time.

Tom and Chuck's definition of technical service is as broad as their experience. They'll help on shipping, equipment, unloading and storage problems, any aspect of production involving our chemicals—formulations, equipment recommendations, methods, start-up runs, costs. There's nothing cut-and-dried about their approach either. You'll find they'll listen to your slant on things . . . will be glad to exchange ideas with you.

These men work for you more than they work for us. Try them out if you have any problems on your next shipment of fertilizer raw materials—ammonia, nitrogen solutions, sulfuric or phosphoric acid.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in Principal Cities

AMMONIA • NITROGEN SOLUTIONS • SULFURIC ACID • PHOSPHORIC ACID

CHANGES

Armour Buys Ris-Van From Stepan Chemical

Armour Agricultural Chemical Company has acquired Ris-Van, Inc. one of the corn belt's leading producers of liquid mixed fertilizers, with seven plants in Iowa and Minnesota.

William Wood Prince, Armour and Co. president, and Alfred C. Stepan, Jr., president of Stepan Chemical Company, of Chicago, announced jointly that Stepan has sold the wholly-owned subsidiary, Ris-Van, Inc., of Belmond, Iowa, to Armour. The present business will continue under the Ris-Van name as a division of Armour Agricultural Chemical Company, and the present staff will be retained. Ris Van will thus be provided with a more complete line of basic materials for its operations.

Stepan Chemical Company plans to use the proceeds of the sale to enter manufacture of a new anti-knock gasoline additive.

Continuing in the management of Ris-Van will be Kenneth Van Duzer, president; Dr. John L. Strauss, former Purdue University agronomist and a vice president of Ris-Van, who was one of the early developers of liquid fertilizers and has directed the scientific work of the company; M. B. Hawke, sales manager and secretary, and Roy E. Carwell, treasurer.

The Ris-Van plants are located at Belmond, West Union, Sanborn, Vinton and Jefferson, Iowa, and at Blue Earth and Wellmar, Minnesota.

Armour Agricultural Chemical headquarters are in Atlanta, Ga. W. E. Shelburne is president.

Cotton Producers Buy Pilcher

The Cotton Producers Assn., Atlanta, has bought the fertilizer mixing plant of J. L. Pilcher & Sons, Inc. at Meigs, Ga. J. S. Parkman will continue as plant superintendent. This becomes CPA's sixth fertilizer plant in the state; the fifth was added last year when they purchased the McConnell Fertilizer plant at Royston. CPA also bought the Hulme Fertilizer plant at Athens last year, but is operating that facility only as a warehousing and distributing unit.

Federal Chemical Buys Wisconsin Coop. Plant

Federal Chemical Company, Louisville, Kentucky, a Division of National Distillers & Chemical Corporation, has announced the purchase of the fertilizer plant at Whitewater, Wisconsin from Wisconsin Farmco Service Cooperative. The plant produces high analysis, fully pelleted, commercial fertilizers recommended for use by the state universities in the rich agricultural region of southern Wisconsin and northern Illinois.

Acquisition of the Whitewater plant, located 45 miles south east of Madison, Wisconsin, will enable Federal to market their fertilizers in Wisconsin and to improve service to their customers in northern Illinois who have been served from its Danville, Illinois plant.

Arnold Buys Monroe Gin and Fertilizer

H. M. Arnold Fertilizer Co. at Monroe, Ga., has bought the Monroe Gin and Fertilizer plant from Southern Cotton Oil Div. of Hunt Foods & Industries. The Arnold firm will operate the plant as a subsidiary this season, in addition to their other plant at Monroe.

Columbia-Southern Now Division of Parent Company

Columbia-Southern Chemical Corporation, a wholly-owned subsidiary, has become a division of Pittsburgh Plate Glass Company.

The new division will operate under the name of Pittsburgh Plate Glass Company, Chemical Division. Principal officers of Columbia-Southern Chemical Corporation have been elected as officers of Pittsburgh Plate Glass Company. Joseph A. Neubauer has become vice president and general manager, Chemical Division, and Chris F. Bingham has become vice president-Chemical Sales. The general direction and management of the chemical operations will not be affected by this corporate change.

The company operates an anhydrous ammonia plant at Natrium, W. Va.

R. W. Phillips Re-opens Green Bay Office

R. W. Phillips has resigned his position as manager of the Chemical Engineering Service division of Manitowoc Shipbuilding Inc., Manitowoc, Wis. in order to re-establish his former business in Green Bay, Wis., stating that he feels he "can better fulfill the industry needs and provide a wider range of services as an independent engineer and manufacturer."

Before going with the Manitowoc firm, he owned and operated Chemical Engineering Service, Inc., established in Green Bay in 1944 and operated until 1956, constructing and installing machinery and complete plants throughout the U. S.

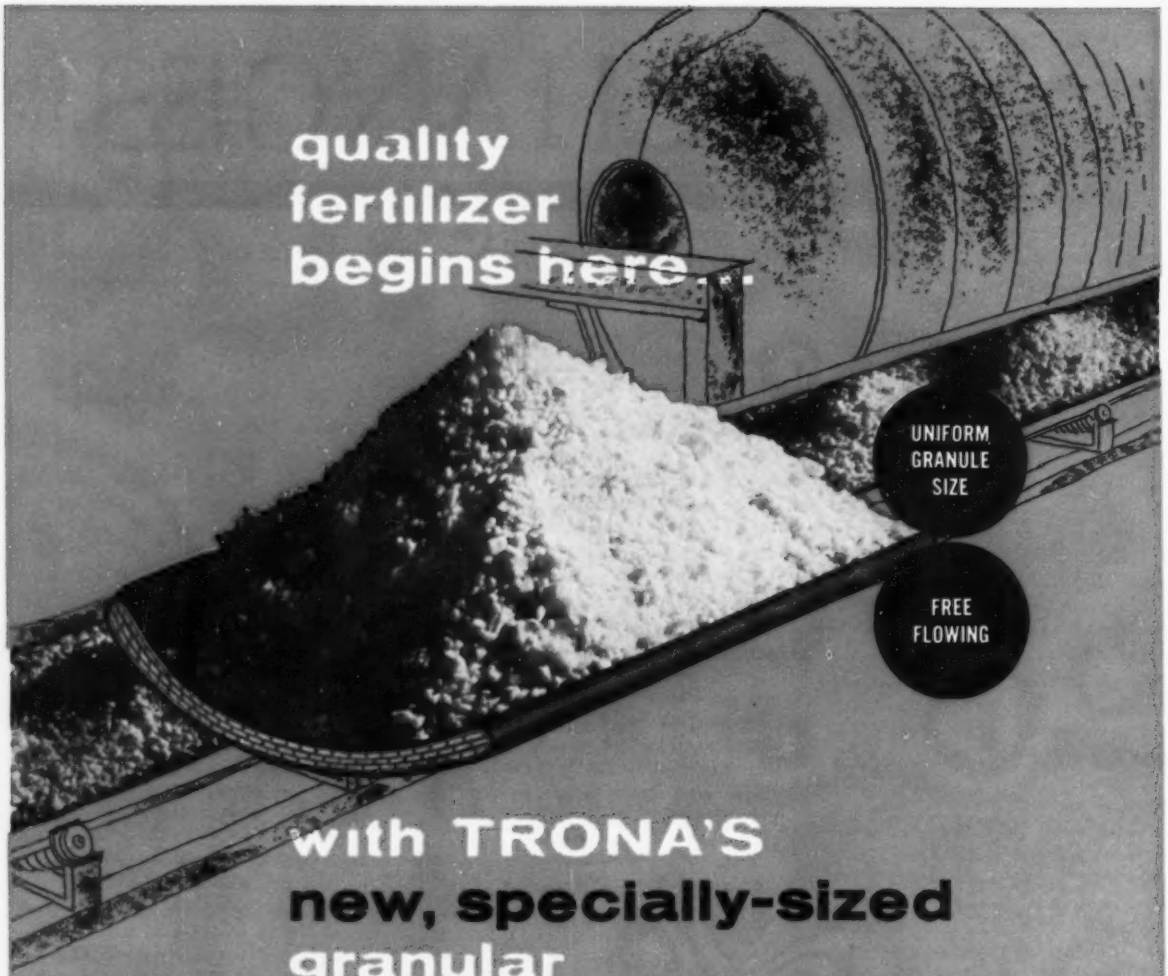
The firm will be known as Chemical Engineering Service of Green Bay. All construction will be handled under another corporation established in 1950 and known as Chemical Engineering and Construction Corp. The firms will be able to work under the method best suited to the owner or customer, whether it be design only (for custom fabrication locally), complete plants, or machinery sales on a competitive basis. The firm equipped and constructed many plants under this system in former years. All work and machinery will be on a guaranteed basis, Mr. Phillips states.

Temporary offices of Chemical Engineering Service are at 2231 Early St., Green Bay, Wisc.

Schutte Appoints New Mid-West Distributor

Schutte Pulverizer Co., Inc. of Buffalo, N. Y., has appointed General Mill Supply Inc., Marion, Iowa, as its new factory distributor and warehouse in the Midwest.

General Mill Supply will stock a complete line of Schutte hammermills and parts to assure immediate delivery throughout its sales territory.



with TRONA'S
new, specially-sized
granular

POTASH

Quality fertilizer granulation begins with **Trona's** all-new, specially-sized granular muriate of potash. The carefully regulated and controlled screen size results in reduced segregation and uniformity of finished product. Whatever your mixing method—batch or ammoniation, **Trona's** new granular assures a quality fertilizer uniform in particle size.

TRONA **American Potash & Chemical Corporation**

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Main Office: 3000 West Sixth Street, Los Angeles 54, California
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Producers of: **BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM • BROMINE • CHLORATES PERCHLORATES • MANGANESE DIOXIDE** *and other diversified chemicals for Industry and Agriculture*

—Changes...

Green Belt Acquires Ohio Liquid Fertilizer

Green Belt Chemical Co., St. Paris, Ohio, has purchased Ohio Liquid Fertilizer Co., South Solon.

Green Belt President M. K. Miller said the purchase was a natural expansion move by Green Belt. Ohio Liquid will be operated as a wholly-owned subsidiary and its president, O. L. Ohnstad, will assist the new management as a consultant. Mr. Ohnstad is a past president of the National Fertilizer Solutions Association.

John Steinberger, St. Paris agronomist, will head an expanded sales program, while Maynard Mickle will continue as plant production manager. No change in company or brand name is contemplated, according to Mr. Miller.

The acquisition is the fifth expansion by Green Belt in Ohio, Indiana and Kentucky in the past five years.

A. O. Smith and Kobe Steel Create Shinko-Smith Co.

A. O. Smith International S. A. has entered into a joint venture with a Japanese steel company for the manufacture of equipment for the oil refining, petro-chemical and fertilizer industries, it was announced by D. J. O'Connell, president of the A. O. Smith Corp. subsidiary.

The firm, formed by A. O. Smith International and the Kobe Steel Works, will be known as the Shinko-Smith Co., with headquarters in Kobe, Japan. Kobe Steel will hold 60% of the stock and the A. O. Smith subsidiary 40%.

A. O. Smith International also has a manufacturing agreement for pressure vessels with Ruhrstahl, Dusseldorf, Germany, covering the European market.

Arizona Fertilizer Buys Oasis Chemical

Arizona Fertilizer & Chemical Co., Phoenix, has announced purchase of Oasis Chemical Co. and its sales outlet, Valley Insecticide Service Co., both of Imperial, Calif.

The firms will be operated by Arizona Fertilizer through its wholly-owned subsidiary, the Arical Co. of Blythe, Calif.

The six-year-old Oasis firm manufactures insecticides and nutrient sprays and defoliants. Valley Insecticide's gross annual sales are approximately $600,000. It serves the Imperial Valley area.

SW Agrochemical Merges With Kerley-Arizona

Merger of Southwestern Agrochemical Corp. and Kerley Chemical Corp., Chandler, Ariz., was announced by Duncan A. Sim, general manager of Agrochemical, and R. V. Kerley, president of Kerley.

Effective Jan. 1, the merger gave the enlarged Southwestern Agrochemical Corp. anticipated sales of some $5.5 million annually, it was reported.

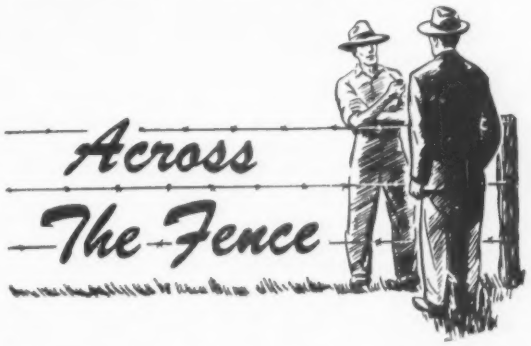
Mr. Sim will continue as manager; Mr. Kerley will become sales manager. Gen. J. C. Wilson of Buckeye and C. P. Gould of Litchfield Park will continue as chairman of the board and president, respectively.

The combined production facilities will turn out the most complete line of agricultural chemicals produced in Arizona, said Messrs. Sim and Kerley. Distribution will be in Arizona, New Mexico, West Texas, Imperial County of California and Mexico.

Doty Buys Grain Exchange Special Lab

Doty Laboratories of Omaha, Nebraska, has purchased the Omaha Grain Exchange Laboratories from the Omaha Grain Exchange. The purchase includes the special laboratory only, and not the Grain Exchange protein laboratory.

E. J. Rosse will be in charge of the combined operation. Doty Laboratories Corporation, 830 Grain Exchange Bldg., Omaha, Nebraska, will now offer complete analytical service to the fertilizer, feed, grain, flour and baking industries in their Omaha laboratory as well as in the Kansas City laboratory.



facts to help you sell

Put your fertilizer where it will do you the most good. This is conducive to more fishing time, according to VPI's extension service. This sage advice came from a study they made, showing that many farmers wasted fertilizer on unsuitable land, and under-fertilized exceptionally productive soil. Lack of efficiency in application, they call it.

U. S. Department of Agriculture studies indicate that every dollar's worth of fertilizer the average farmer used on crops and pastures returned an average of $2.93 per acre last year, National Plant Food Institute reports.

American farmers brought in the biggest harvest in any nation's history last year, despite the fact that acreage planted during '60 was the smallest in nearly half a century, USDA reports. The Department placed the haul for the year at 122% of the 1947-'49 average, 4 points above the previous record set in '58.

This country has by no means reached the production potential of the arable soil we have, says California's Dr. Daniel Aldrich. And fertilizer, properly used, is the answer to feeding the coming millions.

Farmers can make more money growing less corn on fewer acres by using good management practices, says NPFI's Midwest office, explaining that higher yields per acre make lower costs per bushel—and that's where the profit comes from.

Farmers who make money in 1961 will be those who grow crops more efficiently is the good word from University of Wisconsin agronomists. The word "efficiency" embraces better use of lime and fertilizer . . . directed by soil tests.

Shortages of plant food in the soil are cutting crop yields and profits on thousands of Midwestern farms, according to Dr. George E. Smith, chairman of the University of Missouri's soil department. "No general increase in farm income can be attained unless nutrients are added to soils that need them so that high-profit yields of quality crops can be produced."

INDUSTRY PEOPLE

Armour

Robert White has retired as general manufacturing manager of Armour Agricultural Chemical Company after 42 years of service, W. E. Shelburne, president of the company, has announced.

White

Mr. White is being retained by the company as a consultant on fertilizer manufacturing operations, Mr. Shelburne said.

Appointed general manufacturing manager for the fertilizer manufacturing firm in 1955, Mr. White came to the main office in Atlanta in 1934 as general superintendent of all of Armour's fertilizer operations. Previously, he was associated with Armour's Baltimore and Carteret fertilizer plants.

Mr. White developed the practical use of ammonia water and anhydrous ammonia in dry fertilizer mixtures, and, under Mr. White's direction, Armour was one of the first fertilizer manufacturers in the United States to produce high-analysis fertilizers using anhydrous ammonia and phosphoric acid, Mr. Shelburne stated.

St. Regis

St. Regis Paper Company announces that William S. Doolan has been appointed district sales manager of the newly-created South Atlantic district of the bag division. This district includes Georgia, South Carolina, Western North Carolina, and Eastern Tennessee. It is part of the bag division's overall Southeastern regional organization which is under the direction of John B. Brent, regional sales manager, with headquarters in Birmingham, Ala.

Mr. Doolan has been associated with Chemical Packaging in management and sales management posts since 1950. In his new position, he will maintain his functions on behalf of the Chemical Packaging Division and continue to make his headquarters in Savannah. J. J. Weldon will continue as Bag Division sales representative at Atlanta and will report to Mr. Doolan.

IMC

International Minerals & Chemical Corporation has announced two promotions in the materials department of the agricultural chemicals division.

Gerd W. Kraemer, regional sales manager in Minneapolis, Minn., has been named to a new post, assistant

Kraemer

McBride

sales manager of the materials department. He will move to IMC's Skokie, Illinois, headquarters and report to E. C. Horne, sales manager.

Alexander McBride, district sales manager in Kansas City, has been promoted to regional sales manager in Minneapolis. The region includes Minnesota, Wisconsin, Iowa, Upper Michigan, Missouri, Kansas, Nebraska, Eastern Colorado, North and South Dakota.

Texas Gulf Sulphur

John W. Hall, Jr., has joined the domestic sales staff of Texas Gulf Sulphur Company according to an announcement by A. Nelson Myers, vice president and manager of sales. Mr. Hall has been associated with Mantrose Corporation, New York City, since 1947, becoming their director of sales in 1958.

Louisiana State

Dr. Walter K. Porter, professor of plant physiology and director of the cotton quality program at Louisiana State University, became superintendent of the Delta Branch Experiment Station at Stoneville, Feb. 1. He succeeds Dr. William L. Giles, who will become vice president of agriculture and forestry at Mississippi State University.

Williams

Harold C. 'Red' Williams, formerly a sales engineer with Fertilizer Equipment Sales Corp., Atlanta, Ga., has joined Vulcan Iron Works, Chattanooga, Tenn., as assistant to the chief engineer.

Federal Chemical

John R. Sargent retired as senior vice president of Federal Chemical Company in January. He joined the company in 1914 as a field sales representative, and served in various executive capacities prior to moving to Louisville to head the company's sales organization in 1945.

Sargent

Stadler Fertilizer

Robert Blackiston has been named sales representative by Stadler Fertilizer Co., Cleveland, O.

Mr. Blackiston has been with Druid-Hill Seed Co., Baltimore, as a sales representative for ten years, and succeeds Edward Molnar, who resigned from the firm. He will cover the territory in Ohio, Kentucky and Pennsylvania.

N. C. State

Dr. Walter J. Fitts, head of the North Carolina State College soils department, is participating in a fertilizer survey for the Indian government at the request of the United Nations.

Dr. Fitts first went to Rome, where he conferred with soil scientists of the Food and Agriculture Organization of the UN before going to India. He planned to complete his mission about Feb. 1. Dr. Fitts immediate past president of the American Society of Soil Scientists.

SunOlin

Norton H. Walton has been appointed assistant operating superintendent in charge of the SunOlin Chemical Company urea plant at Claymont, Del. Prior to joining SunOlin, Mr. Walton was employed by Atlantic Refining Company for 27 years. He has been instrumental in organizing symposiums on safety for the national meetings of the American Institute of Chemical Engineers.

SunOlin is an affiliate of Sun Oil Company and Olin Mathieson Chemical Corporation.

Virginia-Carolina

A number of appointments have been made by Virginia-Carolina Chemical, in addition to the two reported here last month:

Dr. D. Scott Sears has become director of research for the chemicals division. He joined V-C in 1952.

C. V. O. Hughes, nine years with V-C, is now manager of the mining divisions Florida operation, while Robert J. Murphy, for 12 years superintendent in charge at the Nichols plant, has become personnel and safety manager for the Nichols mining operation.

In the traffic department, J. Langhorne Tompkins is general manager, and Stuart E. Nullally manages the department in the home office. Mr. Tompkins joined V-C in 1941; Mr. Nunally in 1947.

J. M. Rippy has moved to Albany, Ga., from Mobile, Ala.; C. H. Erwin has transferred from Little Rock, Ark., to Memphis, Tenn.,—both as assistant fertilizer plant superintendents.

Farm Fertilizers

Appointment of Arthur C. Jetter as vice president and secretary of Farm Fertilizers, Inc., Omaha, Nebraska, has been announced by Richard E. Bennett, president.

With the company for thirteen years, Mr. Jetter has been secretary and assistant treasurer.

Armwell J. Jones has been appointed assistant treasurer. He has been with the company for seven years.

Olin Mathieson

John O. Logan has been appointed general manager of the chemicals division, Olin Mathieson Chemical Corporation, it was announced by Stanley de J. Osborne, president.

Logan

A corporate vice president, Mr. Logan succeeds the late Edward Block as manager of the largest of Olin Mathieson's six operating divisions. He formerly was associate general manager.

Mr. Logan joined Mathieson Chemical Corporation in 1931. Sales manager for industrial chemicals when Olin and Mathieson merged in 1954, he was later named a corporate vice president.

McVickar Hamilton Jaqua

Ortho

The imminent opening of California Chemical's Ortho division's new $22,000,000 plant at Fort Madison, Iowa, has brought about a broadening of staff functions and the upping of personnel (See Map).

William E. Jaqua and L. R. Hamilton are now respectively national manager and assistant for national sales. Dr. M. H. McVickar is chief agronomist. These three have been concerned only with Western operations.

W. E. Cody Western regional manager announces promotions in the Western operation, with Richard B. Price and John M. Hayden in newly created positions, respectively as regional products manager and assistant. Richard Freeland has joined the Ortho division as a sales representative.

Davison Chemical

Appointment of Harry K. Stueber as export sales manager, agricultural chemicals, is announced by D. N. Hauseman, vice-president, W. R. Grace & Co. Davison Chemical division. Mr. Stueber has had intensive sales experience in Latin America and Europe, and is fluent in several foreign languages. In his new post he succeeds William M. Rohrer, now assistant general sales manager, agricultural chemicals.

Mark H. German has succeeded Basil Wagner, Jr., resigned, as territory representative for Davison on agricultural chemicals, working out of Baltimore and covering the states of Illinois, Michigan, Wisconsin and Minnesota and the southeastern portion of Iowa.

Cyanamid

J. Miller Porter of the phosphate and nitrogen department of the agricultural division of American Cyanamid Company retired on January 1. During his thirty-two years of service he held various managerial positions with the company pertaining to research and chemical engineering, manufacturing, and administration.

Smith-Douglass

James A. Monroe, Smith-Douglass Co., Inc., vice president for operations, has announced the appointment of James F. Roe as manager of the company's Texas City, Texas, operation.

Mr. Monroe also announced that Herman G. Powers, who has managed the Texas City plant since early 1959, would be transferred to the company's home office in Norfolk, Va., to become assistant to the production manager, fertilizer division.

Mr. Roe comes to Smith-Douglass from International Minerals and Chemical Corporation, where he served as general manager of their Bonnie, Fla., chemical plant. Prior to employment with IMC, he had extensive chemical production experience with Industrial Rayon Corporation and Monsanto Chemical Company.

Ag Business Co.

Agricultural Business Company, Lawrence, Kansas, has recently announced appointment of C. G. Walker, Des Moines, Iowa as sales representative for their new line of equipment supplied to the fertilizer industry.

Walker

Mr. Walker will continue to live in Des Moines and will represent the company on the new balanced liquid fertilizer plant which will be offered to the liquid fertilizer industry, the new Agri-Blend dry fertilizer blending plant which will be offered to the dry blend industry and a complete line of liquid fertilizer and dry fertilizer application equipment to complement these lines.

Mr. Walker will also represent the company with the Soil Management Service which is a franchise available to dealers and manufacturers of both liquid and dry fertilizer. Mr. Walker was formerly with Monsanto Chemical Company and Allied Chemical Corporation.

Geigy

Three appointments have been announced by Geigy Agricultural Chemicals: D. L. Odle will represent them in Iowa; Douglas Knapp in southern Florida; Leo K. Calhoun in Alabama. All have had previous close contacts with agriculture.

—Industry People...

Eight employees who this year reached the 25 year mark with International Minerals & Chemical Corporation are honored at dinner in Skokie, Illinois, headquarters. Left to right are Edward Wozniak, Buffalo, New York; Fred Summerfield, William Ackerson, and Nicola Napolitano, all of Niagara Falls, New York; George Hammette, Orlando, Florida; R. N. Bryan, Mulberry, Florida; H. G. Strange, Bartow, Florida; and Guy Hendrickson, Custer, South Dakota.

Bemis

Philip C. McGrath, who has been with Bemis Bro. Bag Company for over 47 years and served as manager of the St. Louis bag plant and sales division from 1953 until last October, retired from the company on January 30.

Louis J. Finn, manager of the Bemis plant and paper mill in Peoria, Ill., also retired from the company on January 30. He had been with Bemis for almost half a century and associated with the Bemis Peoria plant since 1925.

McGrath

Baker

John D. Richards, manager of the Seattle plant of Bemis Bro. Bag Company and head of Bemis' Pacific Northwest sales division, retired January 30 after more than 36 years with the company.

Mr. Richards will be succeeded by E. G. Muir, assistant manager of the plant and sales division. Mr. Muir joined the company in 1949 as a salesman.

The appointment of Robert L. Baker, Jr., as sales executive in charge of the Cleveland sales office of Bemis Bro. Bag Company was announced by T. H. Ashton, director of central operations.

Mr. Baker joined the company nearly 25 years ago.

Zimmer

Appointment of Carl F. Zimmer as sales manager of the Kansas City sales division was also announced by Mr. Ashton. Mr. Zimmer joined Bemis in 1947.

Mississippi Co-op

W. S. Nash, 15-years in Mississippi Federated Cooperatives fertilizer plants, who has served as manager of the MFC Meridian plant since 1953 has been transferred to Hattiesburg where he will manage the fertilizer factory recently purchased by MFC. The veteran fertilizer manufacturer started with the Federation at Corinth. He managed that facility from 1950 to 1953.

Davidson-Kennedy

Davidson-Kennedy Company, Atlanta machinery manufacturer, has named Tom C. Campbell vice president. He will also serve as president of Manufacturers Products Company, a wholly owned subsidiary. The announcement was made by Thornton Kennedy, Davidson-Kennedy Company president.

Campbell

Prior to joining Davidson-Kennedy Company, Mr. Campbell was regional manager of Foote Bros. Gear and Machine Corp. formerly Whitney Chain Company. He was previously Production Engineer at Central Soya Company, Chattanooga.

In his new capacity Campbell will direct sales for Davidson-Kennedy Company.

Mid-South Chemical

Several personnel changes and territory shifts for Mid-South Chemical Corporation of Memphis have been announced by David H. Bradford Jr., vice president and sales manager of the firm, which markets ammonia in 11 central states.

Francis Leeper, from the Midwest division, has become manager of the Southern division with headquarters at New Iberia, La.

Alex Vann, former district salesman at Vincennes, Ind., is now assistant manager of the Midwest division at North Pekin, Ill.

Loyd Lent becomes district manager in charge of the Mt. Vernon, Ind., terminal area.

F. L. (Bud) Mounce, from the auditing department, has joined the sales department as a district manager headquartering at Pesotum, Ill.

L. A. Webb, manager of the Midwest Division, will also head a new department within the company—Training and Special Activities Department.

Joe Story, formerly in charge of several retail outlets in the Midwest Division, becomes district manager in the Southern Illinois and Kentucky area.

Lonnie H. Floyd has been assigned as a district manager in the Lower Rio Grande Valley of Texas.

U of Wisconsin

Professor C. J. Chapman, for nearly 45 years one of the nation's most ardent advocates of fertilizer, and plenty of it, has retired from the University of Wisconsin, which he joined in 1921 to supervise the soils laboratory. He has been called the "Soil Saving Circuit Rider."

Union Bag-Camp

Union Bag-Camp Paper Corporation has announced that Dr. William H. Aiken will join the company on February 15 as director of research and development.

Aiken

Prior to joining the Union-Camp organization, Dr. Aiken directed research and development for Gardner Board and Carton Company and its successor, the Diamond Gardner Corporation. Most recently he served both as a director and vice president, research and development engineering, of Personal Products Corporation, one of the Johnson companies.

Aroostook Federation

J. J. Sullivan, for 38 years general manager of the Aroostook (Maine) Federation of Farmers, retired last month in a fanfare of warm praise from many of the firm friends he had made over the years. At a testimonial banquet, he was presented with a plaque by president (also for 38 years) Newman A. Young of the Federation.

Mr. Sullivan has been succeeded by Philip B. Turner, former assistant general manager. Dr. Turner was previously technical field service representative with DuPont.

SYMBOLS OF PLANT LIFE

Because of the complete ignorance of the masses during the Dark Ages, alchemists, with their knowledge of chemistry, were presumed to be in league with the devil. In experimenting with potash, they were forced to resort to signs and symbols. If they didn't . . . the result could be death!

Today, potash means life . . . life to promote food and fiber growth for an ever-growing population.

Southwest Potash Corporation provides a dependable supply of HIGH-K muriate for the plant food industry.

Distillation During 16th Century

SOUTHWEST POTASH CORPORATION

1270 Avenue of the Americas, New York 20, N.Y.

HIGH-K

**A commonly used 15th Century Symbol for Potash*

'Formucharts'

Formulation Charts Simplify Selecting Lowest-Cost Ingredient Combinations for Dry Blending

by John R. Douglas, John I. Bucy and Robert M. Finley

Introduction

In a recent article, *Bulk Blending with Linear Programming,** the use of the linear programming technique to arrive at least-cost mixtures of fertilizer materials was discussed. The article described a method by which possible savings in formulation costs were determined at one location at a particular time.

Since it quickly became apparent that some simple alternative to the more complex mathematics of linear programming was needed, formulation charts were developed for most of the major types of fertilizer materials currently used by bulk blenders. These "formucharts" were designed as a simplified "highway mileage" type chart which can be easily read by the bulk blender. They are primarily useful where two materials each containing two plant nutrients are being considered, i.e., 30-10-0 and 16-48-0. Those for single nutrient materials may also be useful. All three primary nutrients have been incorporated into these formucharts.

Formucharts have been developed for the following combinations of fertilizer materials.

Formuchart Number	Material
30-21	30-10-0 and 21-53-0
30-18	30-10-0 and 18-46-0
30-16	30-10-0 and 16-48-0
30-13	30-10-0 and 13-39-0
30-11	30-10-0 and 11-48-0
30-46	30-10-0 and 0-46-0
30-54	30-10-0 and 0-54-0
30-62	30-10-0 and 0-62-0
33-21	33.5-0-0 and 21-53-0
33-18	33.5-0-0 and 18-46-0
33-16	33.5-0-0 and 16-48-0
33-13	33.5-0-0 and 13-39-0
33-11	33.5-0-0 and 11-48-0
21-21	21-0-0 and 21-53-0
21-18	21-0-0 and 18-46-0
21-16	21-0-0 and 16-48-0
21-13	21-0-0 and 13-39-0
21-11	21-0-0 and 11-48-0
45-21	45-0-0 and 21-53-0
45-18	45-0-0 and 18-46-0
45-16	45-0-0 and 16-48-0
45-13	45-0-0 and 13-39-0
45-11	45-0-0 and 11-48-0
Straight	*All single nutrient materials*

Others will be developed as new materials are developed and made available in commercial quantities.

Two primary uses have been found for the charts. By using the entire set of charts and computing the cost per unit of plant nutrient for a desired grade or ratio with each combination of different materials, the least-cost combination of plant nutrients may be found. Then, after the least-cost combination has been ascertained and the actual blending begins, the one appropriate formuchart may be used to determine the correct number of pounds of each material to be used in each batch, or for each individual order.

The explanation of these two uses is taken up in reverse order below for simplicity.

Use of Formucharts for Batch Mixing

We will assume, for the time being, that the proper combination of materials for least-cost mixtures has been found to be ammonium nitrate (33.5-0-0), and a modified diammonium phosphate (18-46-0), together with muriate of potash (0-0-60). Thus, we would use formuchart 33-18 for computing the pounds of each material needed for each batch.

Suppose, for example, the farmer's order should be for 300 pounds each of nitrogen, phosphate, and potash—the equivalent of one ton of 15-15-15 grade mixed fertilizer. The bulk blender turns to formuchart 33-18 and reads down the nitrogen scale to 300 pounds (or 15 units) nitrogen requirements; then, he reads along this horizontal line until he comes to its intersection with the vertical column under 300 pounds (or 15 units) phosphate requirements. From the block in this intersection he reads the requirements in terms of pounds of ammonium nitrate and diammonium phosphate to be 546 and 653 respectively. The third figure in the block represents the number of units of potash which it is possible to enter into a short ton of resulting mix if the weight limitation of 2,000 pounds is not exceeded. In this example we see, however, that it is not necessary to use the full 2,000 pounds but instead we use only 500 pounds of potash together with the combined total of 1,199 pounds of the other two materials and all requirements of the farmer's order are fulfilled.

If the operator of the bulk-blending plant wishes to mix exactly one ton of material (i.e., 2,000 pounds) in this same 1-1-1 ratio, it is relatively simple to project the proportion of each material. In the case above, the projection or "jack-up" factor would be 2,000 (the total weight desired) divided by 1,699 (total weight of the batch mixture), or 1.177. Then multiplying each quantity of material required by the jack-up factor, we find that 642 pounds of ammonium nitrate, 769 pounds of 18-46-0, and 589 pounds of 60 percent potash can be blended to form one ton of a 1-1-1 ratio analyzing slightly over 17.6-17.6-17.6.

As the operator of the bulk-blending plant gains experience in using the formucharts, he finds progressively more uses of them. At the

The Authors

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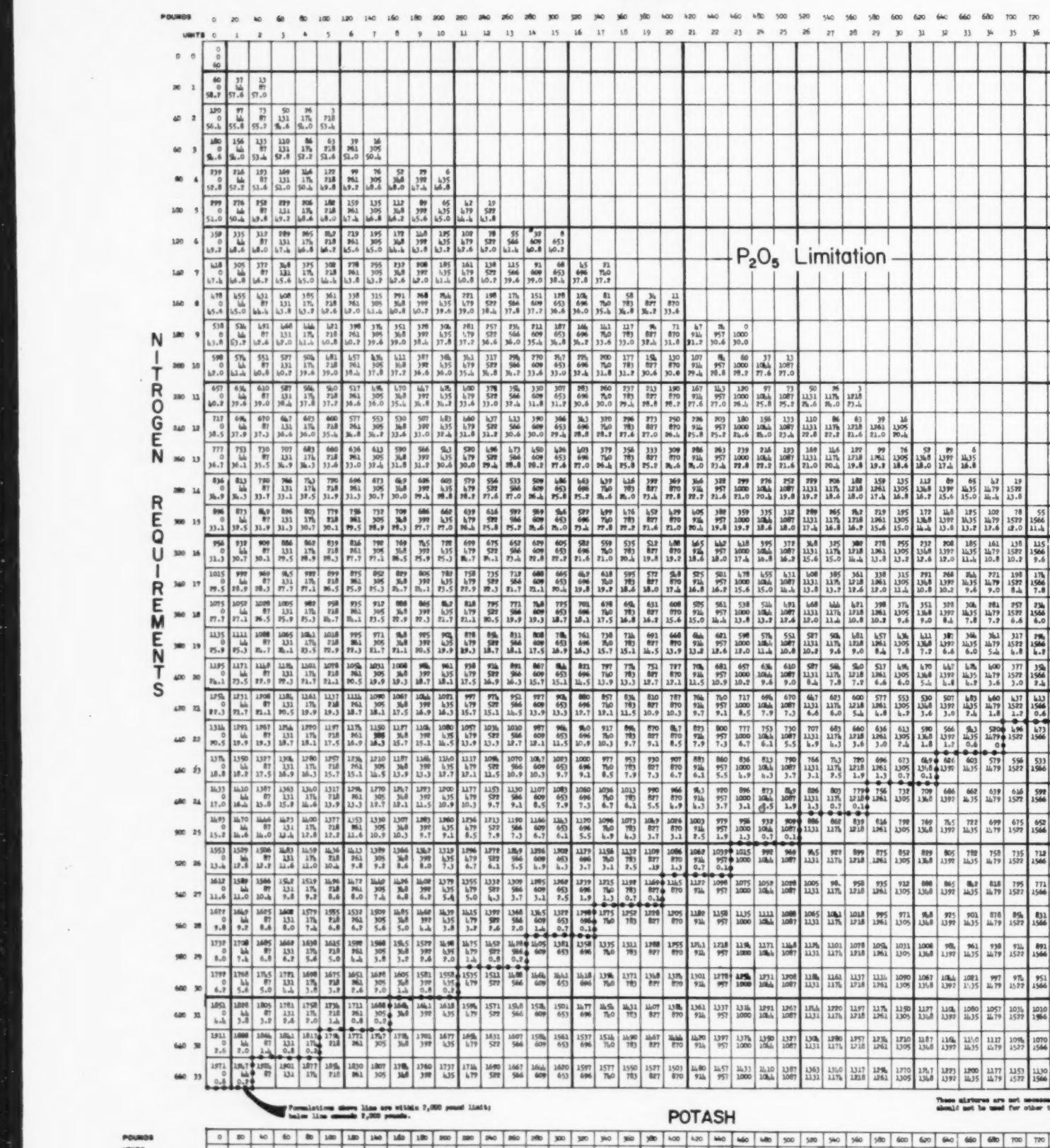
*Commercial Fertilizer, *November 1960, pp. 23-30.*

Formuchart 33-18



rmulation Chart — (33.5-0-0, 18-46-0 and 0-0-60)

Pull out to unfold

720	740	760	780	800	820	840	860	880	900	28
36	37	38	39	40	41	42	43	44	45	46

LEGEND

TOP FIGURE - Pounds 33.5-0-0
SECOND FIGURE - Pounds 18-46-0
THIRD FIGURE - Maximum Number Units of Potash (0-0-60) Possible Within 2,000 Pound Limit

55 1566 11.4	33 1609 10.8	8 1653 10.2								
115 1566 9.6	91 1609 9.0	68 1653 8.4	45 1696 7.8	21 1740 7.2						
176 1566 7.8	151 1609 7.2	126 1653 6.6	101 1696 6.0	81 1740 5.4	58 1783 4.8	34 1827 4.2	12 1870 3.6			
236 1566 6.0	211 1609 5.4	187 1653 4.8	164 1696 4.2	141 1740 3.6	117 1783 3.0	94 1827 2.4	71 1870 1.8	47 1914 1.2	24 1957 0.6	0 2000 0
296 1566 4.2	270 1609 3.6	247 1653 3.0	224 1696 2.4	200 1740 1.8	177 1783 1.2	154 1827 0.6	130 1870 0	107 1914 0	84 1957 0	60 2000 0
356 1566 2.4	330 1609 1.8	307 1653 1.2	283 1696 0.6	260 1740 0	237 1783 0	213 1827 0	190 1870 0	167 1914 0	143 1957 0	120 2000 0
413 1566 0.6	390 1609 0	366 1653 0	343 1696 0	320 1740 0	296 1783 0	273 1827 0	250 1870 0	226 1914 0	203 1957 0	180 2000 0
473 1566 0	450 1609 0	426 1653 0	403 1696 0	379 1740 0	356 1783 0	333 1827 0	309 1870 0	286 1914 0	263 1957 0	239 2000 0
533 1566 0	509 1609 0	486 1653 0	463 1696 0	439 1740 0	416 1783 0	392 1827 0	369 1870 0	346 1914 0	322 1957 0	299 2000 0
592 1566 0	569 1609 0	546 1653 0	522 1696 0	499 1740 0	476 1783 0	452 1827 0	429 1870 0	405 1914 0	382 1957 0	359 2000 0
652 1566 0	629 1609 0	605 1653 0	582 1696 0	559 1740 0	535 1783 0	512 1827 0	488 1870 0	465 1914 0	442 1957 0	418 2000 0
712 1566 0	688 1609 0	665 1653 0	642 1696 0	618 1740 0	595 1783 0	572 1827 0	548 1870 0	525 1914 0	501 1957 0	478 2000 0
771 1566 0	748 1609 0	725 1653 0	701 1696 0	678 1740 0	654 1783 0	631 1827 0	608 1870 0	585 1914 0	561 1957 0	538 2000 0
831 1566 0	808 1609 0	784 1653 0	761 1696 0	738 1740 0	714 1783 0	691 1827 0	668 1870 0	644 1914 0	621 1957 0	598 2000 0
891 1566 0	867 1609 0	844 1653 0	821 1696 0	797 1740 0	774 1783 0	751 1827 0	727 1870 0	704 1914 0	681 1957 0	657 2000 0
951 1566 0	927 1609 0	904 1653 0	880 1696 0	857 1740 0	834 1783 0	810 1827 0	787 1870 0	764 1914 0	740 1957 0	717 2000 0
1010 1566 0	987 1609 0	964 1653 0	940 1696 0	917 1740 0	894 1783 0	870 1827 0	847 1870 0	823 1914 0	800 1957 0	777 2000 0
1070 1566 0	1047 1609 0	1023 1653 0	1000 1696 0	977 1740 0	953 1783 0	930 1827 0	907 1870 0	883 1914 0	860 1957 0	836 2000 0
1130 1566 0	1107 1609 0	1083 1653 0	1060 1696 0	1036 1740 0	1013 1783 0	990 1827 0	966 1870 0	943 1914 0	920 1957 0	896 2000 0

t necessarily compatible for long periods of time and thus r other than straight bulk blending for immediate use.

700	720	740	760	780	800	820	840	860	880	900	920
35	36	37	38	39	40	41	42	43	44	45	46
1267	1300	1334	1367	1400	1434	1467	1500	1534			

FORMULATION CHART—33.5-0-0 and 18-46-0

(One pound increments through 20 pounds, to be used for interpolation between units)

P_2O_5 REQUIREMENTS (pounds)

NITROGEN REQUIREMENTS (pounds)

N \ P_2O_5	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0 0																				
1	3.0 0	1.9 2.2	.7 4.4																		
2	6.0 0	4.9 2.2	3.7 4.4	2.5 6.6	1.3 8.7	.2 10.9															
3	9.0 0	7.8 2.2	6.7 4.4	5.5 6.6	4.3 8.7	3.2 10.9	2.0 13.1	.8 15.3													
4	12.0 0	10.8 2.2	9.7 4.4	8.5 6.6	7.3 8.7	6.1 10.9	5.0 13.1	3.8 15.3	2.6 17.4	1.5 19.6	.3 21.8										
5	15.0 0	13.8 2.2	12.6 4.4	11.3 6.6	10.3 8.7	9.1 10.9	8.0 13.1	6.8 15.3	5.6 17.4	4.5 19.6	3.3 21.8	2.1 24.0	.9 26.1	0 28.3							
6	18.0 0	16.8 2.2	15.6 4.4	14.3 6.6	13.3 8.7	12.1 10.9	11.0 13.1	9.8 15.3	8.6 17.4	7.4 19.6	6.3 21.8	5.1 24.0	3.9 26.1	2.8 28.3	1.6 30.5	.4 32.7	0 34.8				
7	20.9 0	19.8 2.2	18.6 4.4	17.4 6.6	16.3 8.7	15.1 10.9	13.9 13.1	12.8 15.3	11.6 17.4	10.4 19.6	9.3 21.8	8.1 24.0	6.9 26.1	5.8 28.3	4.6 30.5	3.4 32.7	2.3 34.8	1.1 37.0	0 39.1		
8	23.9 0	22.8 2.2	21.6 4.4	20.4 6.6	19.3 8.7	18.1 10.9	16.9 13.1	15.8 15.3	14.6 17.4	13.4 19.6	12.2 21.8	11.1 24.0	9.9 26.1	8.7 28.3	7.6 30.5	6.4 32.7	5.2 34.8	4.1 37.0	2.9 39.1	1.7 41.4	.4 43.5
9	26.9 0	25.7 2.2	24.6 4.4	23.4 6.6	22.2 8.7	21.1 10.9	19.9 13.1	18.7 15.3	17.6 17.4	16.4 19.6	15.2 21.8	14.1 24.0	12.9 26.1	11.7 28.3	10.6 30.5	9.4 32.7	8.2 34.8	7.1 37.0	5.9 39.1	4.7 41.4	3.6 43.5
10	29.9 0	28.7 2.2	27.6 4.4	26.4 6.6	25.2 8.7	24.1 10.9	22.9 13.1	21.7 15.3	20.6 17.4	19.4 19.6	18.2 21.8	17.1 24.0	15.9 26.1	14.7 28.3	13.5 30.5	12.4 32.7	11.2 34.8	10.0 37.0	8.9 39.1	7.7 41.4	6.5 43.5
11	32.9 0	31.7 2.2	30.5 4.4	29.4 6.6	28.2 8.7	27.0 10.9	25.9 13.1	24.7 15.3	23.5 17.4	22.4 19.6	21.2 21.8	20.0 24.0	18.9 26.1	17.7 28.3	16.5 30.5	15.4 32.7	14.2 34.8	13.0 37.0	11.9 39.1	10.7 41.4	9.5 43.5
12	35.9 0	34.7 2.2	33.5 4.4	32.4 6.6	31.2 8.7	30.0 10.9	28.9 13.1	27.7 15.3	26.5 17.4	25.4 19.6	24.2 21.8	23.0 24.0	21.9 26.1	20.7 28.3	19.5 30.5	18.3 32.7	17.2 34.8	16.0 37.0	14.8 39.1	13.7 41.4	12.5 43.5
13	38.9 0	37.7 2.2	36.5 4.4	35.4 6.6	34.2 8.7	33.0 10.9	31.8 13.1	30.7 15.3	29.5 17.4	28.3 19.6	27.2 21.8	26.0 24.0	24.8 26.1	23.7 28.3	22.5 30.5	21.3 32.7	20.2 34.8	19.0 37.0	17.8 39.1	16.7 41.4	15.5 43.5
14	41.8 0	40.7 2.2	39.5 4.4	38.3 6.6	37.2 8.7	36.0 10.9	34.8 13.1	33.7 15.3	32.5 17.4	31.3 19.6	30.2 21.8	29.0 24.0	27.8 26.1	26.7 28.3	25.5 30.5	24.3 32.7	23.1 34.8	22.0 37.0	20.8 39.1	19.6 41.4	18.5 43.5
15	44.8 0	43.7 2.2	42.5 4.4	41.3 6.6	40.2 8.7	39.0 10.9	37.8 13.1	36.6 15.3	35.5 17.4	34.3 19.6	33.1 21.8	32.0 24.0	30.8 26.1	29.6 28.3	28.5 30.5	27.3 32.7	26.1 34.8	25.0 37.0	23.8 39.1	22.6 41.4	21.5 43.5
16	47.8 0	46.7 2.2	45.5 4.4	44.3 6.6	43.1 8.7	42.0 10.9	40.8 13.1	39.6 15.3	38.5 17.4	37.3 19.6	36.1 21.8	35.0 24.0	33.8 26.1	32.6 28.3	31.5 30.5	30.3 32.7	29.1 34.8	28.0 37.0	26.8 39.1	25.6 41.4	24.4 43.5
17	50.8 0	49.6 2.2	48.5 4.4	47.3 6.6	46.1 8.7	45.0 10.9	43.8 13.1	42.6 15.3	41.5 17.4	40.3 19.6	39.1 21.8	37.9 24.0	36.8 26.1	35.6 28.3	34.4 30.5	33.3 32.7	32.1 34.8	30.9 37.0	29.8 39.1	28.6 41.4	27.4 43.5
18	53.8 0	52.6 2.2	51.4 4.4	50.3 6.6	49.1 8.7	47.9 10.9	46.8 13.1	45.6 15.3	44.4 17.4	43.3 19.6	42.1 21.8	40.9 24.0	39.8 26.1	38.6 28.3	37.4 30.5	36.3 32.7	35.1 34.8	33.9 37.0	32.8 39.1	31.6 41.4	30.4 43.5
19	56.8 0	55.6 2.2	54.4 4.4	53.3 6.6	52.1 8.7	50.9 10.9	49.8 13.1	48.6 15.3	47.4 17.4	46.3 19.6	45.1 21.8	43.9 24.0	42.7 26.1	41.6 28.3	40.4 30.5	39.2 32.7	38.1 34.8	36.9 37.0	35.7 39.1	34.6 41.4	33.4 43.5
20	59.8 0	58.6 2.2	57.4 4.4	56.2 6.6	55.1 8.7	53.9 10.9	52.7 13.1	51.6 15.3	50.4 17.4	49.2 19.6	48.1 21.8	46.9 24.0	45.7 26.1	44.6 28.3	43.4 30.5	42.2 32.7	41.1 34.8	39.9 37.0	38.7 39.1	37.6 41.4	36.4 43.5

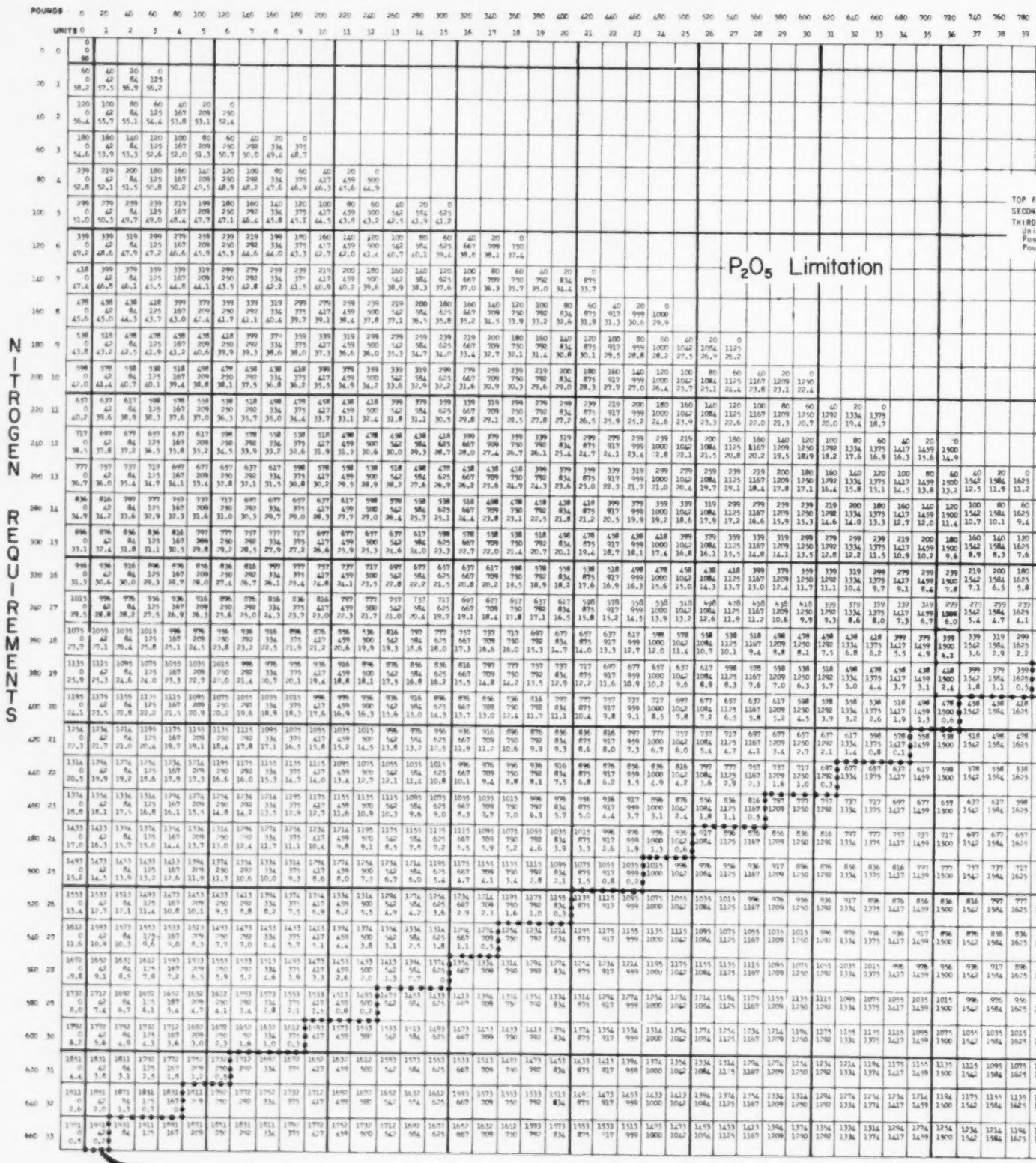
MAXIMUM GRADES AT SPECIFIED RATIOS						
Ratio	Grade			Pounds 33.5-0-0	18-46-0	0-0-60
1-1-0	25.0%	25.0%	00.00	911	1089	-
1-1-1	17.67	17.67	17.67	642	769	589
1-1-2	13.65	13.65	27.30	496	594	910
1-1-3	11.12	11.12	33.36	404	484	1112
1-1-4	9.38	9.38	37.52	341	408	1251
1-2-0	20.01	40.02	00.00	260	1740	-
1-2-1	15.00	30.00	15.00	195	1305	500
1-2-2	12.00	24.00	24.00	156	1044	800
1-2-3	10.00	20.00	30.00	130	870	1000
1-2-4	8.57	17.14	34.28	111	746	1143
2-1-0	28.64	14.32	00.00	1377	623	-
2-1-1	23.14	11.57	11.57	1111	503	386
2-1-2	19.38	9.69	19.38	931	422	647
2-1-3	16.68	8.34	25.02	802	363	835
2-1-4	14.64	7.32	29.28	704	319	977
2-2-1	20.72	20.72	10.36	753	901	346
3-1-0	30.06	10.02	00.00	1504	496	-
3-1-1	25.77	8.59	8.59	1339	374	287
3-1-2	22.56	7.52	15.04	1171	327	502
3-1-3	20.04	6.68	20.04	1041	291	668
3-1-4	18.00	6.00	24.00	937	262	801
3-2-2	20.97	13.98	13.98	926	608	466
4-5-0	23.56	29.45	00.00	719	1281	-

prepared by
Distribution Economics Section
Fertilizer Distribution Branch
Division of Agricultural Relations
Tennessee Valley Authority

Formuchart 33-16

Formula

P_2O_5 REQUIREMENTS

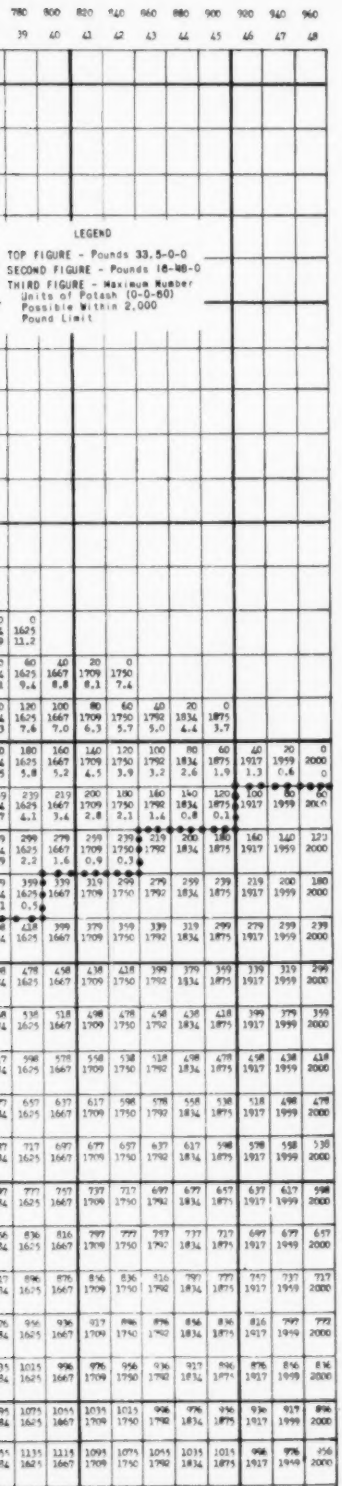


Formulations above line are within 7,000 pound limit; below line exceeds 7,000 pounds.

POTASH

These mixtures are not necessarily com
should not be used for other than stra

POUNDS	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780
UNITS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
POUNDS OF 60% POTASH REQUIRED	0	34	67	100	134	167	200	234	267	300	334	367	400	434	467	500	534	567	600	634	667	700	734	767	800	834	867	900	934	967	1000	1034	1067	1100	1134	1167	1200	1234	1267	1300


780 800 820 840 860 880 900 920 940 960
39 40 41 42 43 44 45 46 47 48
LEGEND
TOP FIGURE - Pounds 33.5-0-0
SECOND FIGURE - Pounds 16-48-0
THIRD FIGURE - Maximum Number Units of Potash (0-0-60) Possible Within 2,000 Pound Limit

FORMULATION CHART—33.5-0-0 and 16-48-0

(One pound increments through 20 pounds, to be used for interpolation between units)

P_2O_5 REQUIREMENTS (pounds)

NITROGEN REQUIREMENTS (pounds)

N \ P_2O_5	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0 0																				
1	3.0 0	2.0 2.1	1.0 4.2	0 6.3																	
2	6.0 0	5.0 2.1	4.0 4.2	3.0 6.3	2.0 8.4	1.0 10.5	0 12.5														
3	9.0 0	8.0 2.1	7.0 4.2	6.0 6.3	5.0 8.4	4.0 10.5	3.0 12.5	2.0 14.6	1.0 16.7	0 18.8											
4	12.0 0	11.0 2.1	10.0 4.2	9.0 6.3	8.0 8.4	7.0 10.5	6.0 12.5	5.0 14.6	4.0 16.7	3.0 18.8	2.0 20.9	1.0 23.0	0 25.0								
5	15.0 0	14.0 2.1	13.0 4.2	12.0 6.3	11.0 8.4	10.0 10.5	9.0 12.5	8.0 14.6	7.0 16.7	6.0 18.8	5.0 20.9	4.0 23.0	3.0 25.0	2.0 27.1	1.0 29.2	0 31.3					
6	18.0 0	17.0 2.1	16.0 4.2	15.0 6.3	14.0 8.4	13.0 10.5	12.0 12.5	11.0 14.6	10.0 16.7	9.0 18.8	8.0 20.9	7.0 23.0	6.0 25.0	5.0 27.1	4.0 29.2	3.0 31.3	2.0 33.4	1.0 35.5	0 37.5		
7	20.9 0	20.0 2.1	19.0 4.2	18.0 6.3	17.0 8.4	16.0 10.5	15.0 12.5	14.0 14.6	13.0 16.7	12.0 18.8	11.0 20.9	10.0 23.0	9.0 25.0	8.0 27.1	7.0 29.2	6.0 31.3	5.0 33.4	4.0 35.5	3.0 37.5	2.0 39.6	1.0 41.7
8	23.9 0	22.9 2.1	21.9 4.2	20.9 6.3	20.0 8.4	19.0 10.5	18.0 12.5	17.0 14.6	16.0 16.7	15.0 18.8	14.0 20.9	13.0 23.0	12.0 25.0	11.0 27.1	10.0 29.2	9.0 31.3	8.0 33.4	7.0 35.5	6.0 37.5	5.0 39.6	4.0 41.7
9	26.9 0	25.9 2.1	24.9 4.2	23.9 6.3	22.9 8.4	21.9 10.5	20.9 12.5	20.0 14.6	19.0 16.7	18.0 18.8	17.0 20.9	16.0 23.0	15.0 25.0	14.0 27.1	13.0 29.2	12.0 31.3	11.0 33.4	10.0 35.5	9.0 37.5	8.0 39.6	7.0 41.7
10	29.9 0	28.9 2.1	27.9 4.2	26.9 6.3	25.9 8.4	24.9 10.5	23.9 12.5	22.9 14.6	21.9 16.7	20.9 18.8	20.0 20.9	19.0 23.0	18.0 25.0	17.0 27.1	16.0 29.2	15.0 31.3	14.0 33.4	13.0 35.5	12.0 37.5	11.0 39.6	10.0 41.7
11	32.9 0	31.9 2.1	30.9 4.2	29.9 6.3	28.9 8.4	27.9 10.5	26.9 12.5	25.9 14.6	24.9 16.7	23.9 18.8	22.9 20.9	21.9 23.0	20.9 25.0	20.0 27.1	19.0 29.2	18.0 31.3	17.0 33.4	16.0 35.5	15.0 37.5	14.0 39.6	13.0 41.7
12	35.9 0	34.9 2.1	33.9 4.2	32.9 6.3	31.9 8.4	30.9 10.5	29.9 12.5	28.9 14.6	27.9 16.7	26.9 18.8	25.9 20.9	24.9 23.0	23.9 25.0	22.9 27.1	21.9 29.2	20.9 31.3	20.0 33.4	19.0 35.5	18.0 37.5	17.0 39.6	16.0 41.7
13	38.9 0	37.9 2.1	36.9 4.2	35.9 6.3	34.9 8.4	33.9 10.5	32.9 12.5	31.9 14.6	30.9 16.7	29.9 18.8	28.9 20.9	27.9 23.0	26.9 25.0	25.9 27.1	24.9 29.2	23.9 31.3	22.9 33.4	21.9 35.5	20.9 37.5	20.0 39.6	19.0 41.7
14	41.8 0	40.8 2.1	39.9 4.2	38.9 6.3	37.9 8.4	36.9 10.5	35.9 12.5	34.9 14.6	33.9 16.7	32.9 18.8	31.9 20.9	30.9 23.0	29.9 25.0	28.9 27.1	27.9 29.2	26.9 31.3	25.9 33.4	24.9 35.5	23.9 37.5	22.9 39.6	21.9 41.7
15	44.8 0	43.8 2.1	42.8 4.2	41.8 6.3	40.8 8.4	39.9 10.5	38.9 12.5	37.9 14.6	36.9 16.7	35.9 18.8	34.9 20.9	33.9 23.0	32.9 25.0	31.9 27.1	30.9 29.2	29.9 31.3	28.9 33.4	27.9 35.5	26.9 37.5	25.9 39.6	24.9 41.7
16	47.8 0	46.8 2.1	45.8 4.2	44.8 6.3	43.8 8.4	42.8 10.5	41.8 12.5	40.8 14.6	39.9 16.7	38.9 18.8	37.9 20.9	36.9 23.0	35.9 25.0	34.9 27.1	33.9 29.2	32.9 31.3	31.9 33.4	30.9 35.5	29.9 37.5	28.9 39.6	27.9 41.7
17	50.8 0	49.8 2.1	48.8 4.2	47.8 6.3	46.8 8.4	45.8 10.5	44.8 12.5	43.8 14.6	42.8 16.7	41.8 18.8	40.8 20.9	39.9 23.0	38.9 25.0	37.9 27.1	36.9 29.2	35.9 31.3	34.9 33.4	33.9 35.5	32.9 37.5	31.9 39.6	30.9 41.7
18	53.8 0	52.8 2.1	51.8 4.2	50.8 6.3	49.8 8.4	48.8 10.5	47.8 12.5	46.8 14.6	45.8 16.7	44.8 18.8	43.8 20.9	42.8 23.0	41.8 25.0	40.8 27.1	39.9 29.2	38.9 31.3	37.9 33.4	36.9 35.5	35.9 37.5	34.9 39.6	33.9 41.7
19	56.8 0	55.8 2.1	54.8 4.2	53.8 6.3	52.8 8.4	51.8 10.5	50.8 12.5	49.8 14.6	48.8 16.7	47.8 18.8	46.8 20.9	45.8 23.0	44.8 25.0	43.8 27.1	42.8 29.2	41.8 31.3	40.8 33.4	39.9 35.5	38.9 37.5	37.9 39.6	36.9 41.7
20	59.8 0	58.8 2.1	57.8 4.2	56.8 6.3	55.8 8.4	54.8 10.5	53.8 12.5	52.8 14.6	51.8 16.7	50.8 18.8	49.8 20.9	48.8 23.0	47.8 25.0	46.8 27.1	45.8 29.2	44.8 31.3	43.8 33.4	42.8 35.5	41.8 37.5	40.8 39.6	39.9 41.7

MAXIMUM GRADES AT SPECIFIED RATIOS						
Ratio	Grade			Pounds		
				33.5-0-0	16-48-0	0-0-60
1-1-0	24.54	24.54	00.00	977	1023	-
1-1-1	17.41	17.41	17.41	693	726	581
1-1-2	13.49	13.49	26.98	537	563	900
1-1-3	11.01	11.01	33.03	439	459	1102
1-1-4	9.30	9.30	37.20	371	388	1241
1-2-0	19.36	38.72	00.00	386	1614	-
1-2-1	14.64	29.28	14.64	292	1220	488
1-2-2	11.76	23.52	23.52	234	981	785
1-2-3	9.83	19.66	29.49	196	820	984
1-2-4	8.45	16.90	33.80	168	705	1127
1-3-0	16.00	48.00	00.00	-	2000	- -
1-3-1	12.63	37.89	12.63	-	1579	421
1-3-2	10.43	31.29	20.86	-	1306	696
1-3-3	8.88	26.64	26.64	-	1111	889
1-3-6	6.15	18.45	36.90	-	769	1231
1-3-8	4.70	14.10	42.30	-	588	1412
2-1-0	28.32	14.16	00.00	1410	590	-
2-1-1	22.90	11.45	11.45	1140	478	382
2-1-2	19.22	9.61	19.22	957	401	642
2-1-3	16.58	8.29	24.87	825	346	829
2-1-4	14.56	7.28	29.12	725	304	971
2-2-1	20.36	20.36	10.18	811	849	340
3-1-0	29.85	9.95	00.00	1585	415	-
3-1-1	25.59	8.53	8.53	1359	356	285
3-1-2	22.41	7.47	14.94	1190	312	498
3-1-3	19.92	6.64	19.92	1058	277	665
3-1-4	17.91	5.97	23.88	953	249	798
3-2-2	20.73	13.82	13.82	963	576	461
4-5-0	23.00	28.75	00.00	801	1199	-

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same time, he finds that they become as simple to read as any highway mileage chart, and much, if not all, of his arithmetic is eliminated. It soon becomes possible for him to keep up with all price changes on materials for himself by use of the method described below.

Use of Formucharts to Determine Least-Cost Combinations of Materials for a Desired Grade

For an example, we will assume the blender desires to determine the least-cost combination of materials to obtain the equivalent in plant nutrients of one ton of 8-16-16 grade fertilizer. There are three simple steps in the computations.

STEP 1—

List the price per pound of each material available at the plant location.

(These prices to be used for this example only.)

	Price Per Ton	Price Per Pound
45-0-0	$101.00	$0.0505
30-10-0	60.60	0.0303
33.5-0-0	68.40	0.0342
21-0-0	39.40	0.0197
21-53-0	102.80	0.0514
18-46-0	83.90	0.04195
16-48-0	83.90	0.04195
13-39-0	78.00	0.03900
11-48-0	80.00	0.04000
0-46-0	52.40	0.0262
0-54-0	62.74	0.03137
0-62-0	74.18	0.03709
0-0-60	38.25	0.019125

STEP 2—

From each formuchart apply pounds of material required (for grade desired) times the price per pound of each raw material.

Example Calculation
Formuchart 33-18
(33.5-0-0, 18-46-0, and 0-0-60)
Grade equivalent desired: 8-16-16

Find the square on the chart where N=8 and P_2O_5=16. Following the intersections of these figures on Formuchart 33-18, we find that 104 pounds of ammonium nitrate (33.5-0-0) and 696 pounds of 18-46-0 are required for 8 units of N and 16 units of P_2O_5. We then go to the bottom of the chart headed "Potash" under 16 units and obtain 534 which represents the pounds of 60 percent potash required.

From the above we have determined the pounds of material required for the grade 8-16-16. From the price list we obtain price per pound of each material, and multiply the pounds of material by the price per pound to obtain total cost of materials.

104	x $0.0342	=	$ 3.56
696	x $0.04195	=	29.20
534	x $0.019125	=	10.21
	Total Cost		$42.97

The total cost of 8-16-16 equivalent using 33.5-0-0, 18-46-0, and 0-0-60 is $42.97.

Complete the above steps for the formucharts representing all combinations of all materials which are available for use at the time and location of our example.

STEP 3—

Compare the total cost per ton of each of the various formulations.

Chart	Total Cost
30-21	$43.90
30-18	42.25
30-16	42.49
30-13	46.30
30-11	43.77
30-46	41.59* (*Least Cost*)
30-54	41.89
30-62	42.38
33-21	44.68
33-18	42.97
33-16	43.66
33-13	47.70
33-11	45.75
21-21	46.70
21-18	45.09
21-16	46.88
21-13	50.92
21-11	51.01
45-21	45.00
45-18	43.35
45-16	44.20
45-13	48.24
45-11	46.64

**Chart* 30-46 (30-10-0, 0-46-0, *and* 0-0-60) *is selected in this example because the total cost of* $41.59 *is the lowest cost combination.*

A Note of Caution

A note of caution should be interjected at this point. Some of the good points of using the formucharts have been set forth but nowhere have the possible shortcomings been noted. There are at least two which should be considered.

First, of course, there is always the possibility that not all possible combinations of materials are considered. This is particularly true with the continuing advent of new and improved fertilizer materials. With each new high nitrogen-low phosphate multinutrient material a whole array of formucharts will be needed. If these aren't available, the necessary mathematical calculations should be made to determine if any of the new possible combinations are less expensive. In short, if the method is to be successful in arriving at the least-cost combinations, *all* possible combinations should be tried.

A second possible shortcoming of this system is one that is equal to, and perhaps greater than, the shortcoming inherent in the linear programming approach. Both systems can be used to determine the least-cost combinations of materials for a grade or a ratio of fertilizer. Bulk blenders, however, must mix many different grades and ratios of final product. Generally, storage space for the unmixed materials is quite limited. It is necessary then that the four or five materials which are decided upon can be used to blend all grades and ratios required, in addition to being the least-cost combinations. No matter what system is used to determine which materials are to be used, some compromise is necessary.

Normally this compromise can best be made by determining the least-cost combination of materials for the most important ratio of plant nutrients which is sold. Then the same procedure is applied for the ratio containing the highest N to P ratio and for the lowest N to P ratio. Many times materials required for all three of these ratios will be identical. If they are not, the blender must then compromise based upon his expectation of his sales pattern. This compromise is one that faces the bulk blender at all times, however, and the use of formucharts may give him more information on which to make his operational decision.

Summary

In summary, then, the use of formucharts has been devised as a simplified method of determining least-cost combinations of materials for a given grade or ratio of fertilizer mixture required. After these least-cost combinations have been determined, the specific formuchart covering the least-cost combination may be used by the bulk blender for each batch of blended material produced. These charts will not do all that linear programming will do, *but* they do make it possible in many cases for the average bulk blender to determine the least-cost materials at his location, and thus enable him to save money for himself and for his farmer-patrons.

Note

For a more complete coverage of least-cost materials, the interested reader is referred to the recent article entitled *Bulk Blending with Linear Programming* in the November issue of Commercial Fertilizer.

Solid and liquid

BULK *FERTILIZER* DISTRIBUTION

1954 and 1959

by Walter Scholl, Marion M. Davis, *and* Caroline A. Wilker

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The first report by the Fertilizer Investigations Research Branch of the United States Department of Agriculture on distribution of fertilizer in bulk was made before the ninth annual convention of the Association of American Fertilizer Control Officials in 1955 and published in their Number 9 Official Publication. The results of that study, based on a survey for the year ended June 30, 1954, has been included with the new data obtained for the year ended June 30, 1959. In addition to shipments of solids, as originally reported, the present compilation includes the separate shipments of liquids for both years. The quantities include only shipments for retail markets.

Information on the total tonnage of each class (mixtures, chemical nitrogen materials, phosphate materials, etc.) shipped to agents, dealers, and consumers was obtained from manufacturers, fertilizer brokers, and the tonnage reports issued by the respective States. Additional information on anhydrous ammonia and nitrogen solutions was obtained from distributors and custom applicators of these products. The tonnages of customer blends or mixtures prepared by dealers and applicators other than manufacturers are not included as such. But the quantities of products (mixtures and materials) used by such operators are included in the reports of respondents who supplied the products. In preparing this survey, it was found that dealers and applicators (exclusive of manufacturers) now publicly classed as "bulk blenders" use both commercial mixtures and direct-application materials for preparing special customer formulations. The products that are used are obtained from manufacturers and distributors, but mostly from farm supply cooperatives on which the tonnage has been reported. Many of the States allow such operators to stipulate only the ingredient and grade used and do not require registration of such blends and mixtures by grade. The quantities of products used by these operators for their blends and mixtures are, therefore, included in the quantities of commercial mixtures and direct-application materials of this report. Additional quantities of products shipped in bulk for use in the manufacture of commercial mixtures and for wholesale trade are not included.

Information was obtained only on the tonnage of fertilizer shipped in bulk. Fertilizer distribution, methods and costs, have been discussed by Abrahamsen (Service Report 19) and bulk distribution of fertilizer and lime in the Northeast was reviewed by Trotter (General Report 24). These reports were released by the Farmer Cooperative Service, U. S. D. A. in 1956 and deal principally with operations of farm supply cooperative plants. Nevertheless, bulk shipments appear universally to be principally a direct plant-to-farm operation with spreader service or contractor service available. A review of the 1959 Commercial Fertilizer and Plant Food Industry Year Book (published by the Walter W. Brown Publishing Co., Inc., Atlanta, Georgia) shows for 942 plants producing solid fertilizers that list their plant facilities, 674 (71.5 percent) list bulk loading facilities. It should be noted that any formulator of solid fertilizer is indeed a bulk producer, though he may bag the product for the market.

The data presented in tables 1 through 5 show: in columns 2 and 3, the tonnage of all commercial fertilizers of class shipped in packaged and non-packaged forms; in columns 4 through 7, the tonnage of non-packaged shipments (bulk shipments); and in columns 8 through 11, the percentage of all shipments of class in area shipped in bulk. The term "bulk" is defined for the fertilizer industry in the Official Publication of the Association and most State Regulations as *a commercial fertilizer delivered to the purchaser, either in the solid or liquid state, in a non-packaged form to which a label cannot be attached.* The tonnage of liquid, in these tables, however, is the total quantity of liquid regardless of size of container. All water soluble solids for dissolution by the consumer are included in the tonnage of solids.

The quantity of solid and liquid fertilizers shipped in bulk for retail markets is shown for each State, the District of Columbia, and Puerto Rico in table 1. In 1959, solids shipped in bulk amounted to 2,742,447 tons. This quantity represented 10.83 percent of all fertilizer shipments in 1959 and was 912,719 tons (49.9 percent) more than the 1,829,728 tons recorded in 1954. The use of liquid fertilizers also increased from 587,997 tons in 1954 to 2,168,508 tons in 1959—an increase of 1,580,511 tons (268.9 percent). The total of bulk shipments, therefore, in 1959 represented 19.40 percent, compared with 10.61 percent in 1954, of all fertilizer shipments.

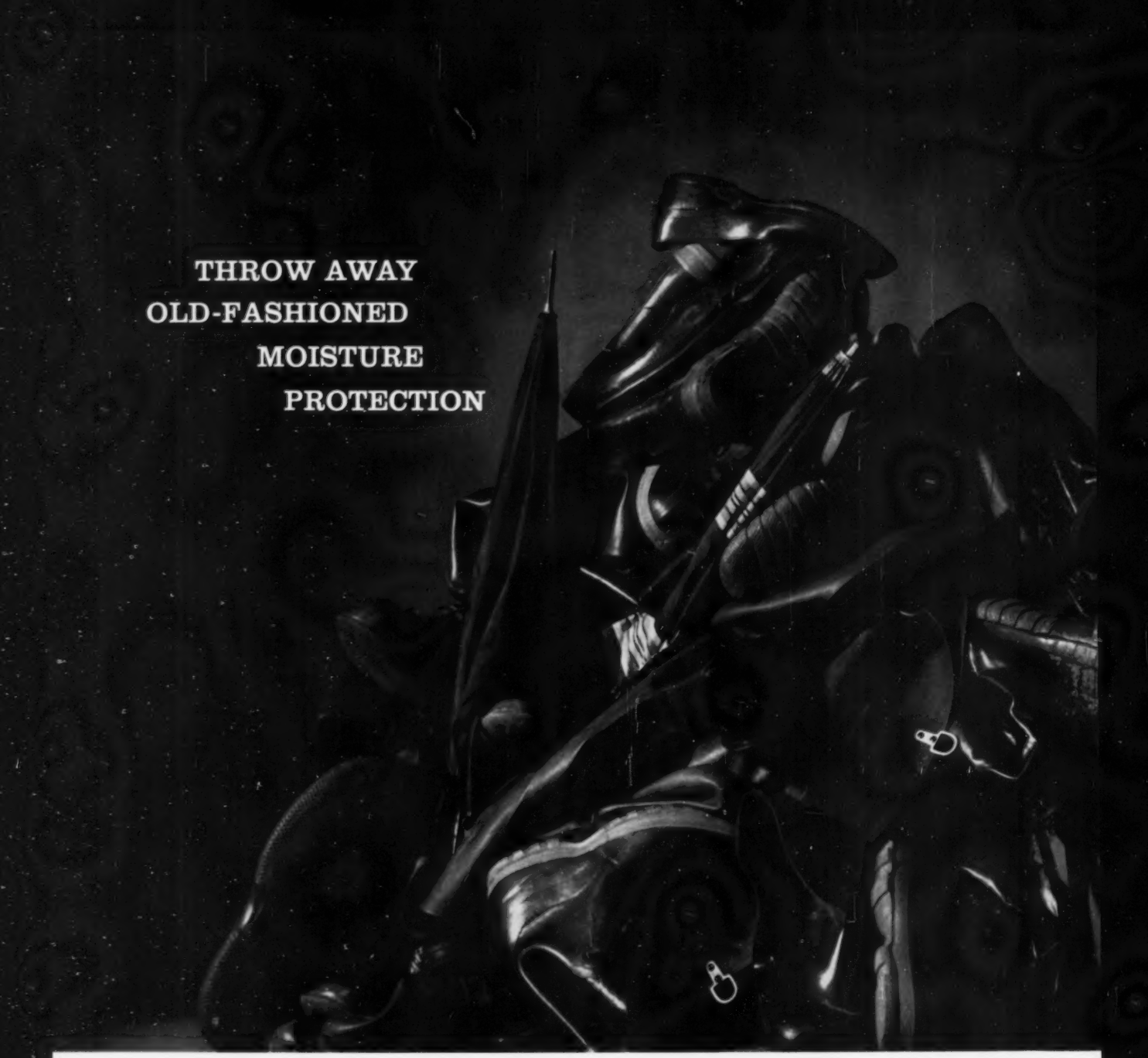
Between 1954 and 1959, the tonnage of bulk shipments more than doubled and increased nearly four-times for liquids but only about one-half again as much for solids. Liquids are a relatively new commodity in the industry and having a much smaller base period tend to show a more rapid growth pattern. Of all fertilizers retailed in 1954, liquids represented but 2.58 percent in comparison with 8.03 percent for solids.

(continued on pages 47, 48)

Table 1. — Fertilizer: Shipments in bulk for retail markets in States and regions, Years ended June 30, 1954 and 1959

State and region	Shipments[1]						Percentage of fertilizer shipments in area shipped in bulk			
	Fertilizer[2]		Bulk							
			Solid		Liquid[3]		Solid		Liquid	
	1954	1959	1954	1959	1954	1959	1954	1959	1954	1959
	Tons	Tons	Tons	Tons	Tons	Tons	Percent	Percent	Percent	Percent
Maine	171,782	180,026	41	34	12	259	0.02	0.02	0.01	0.14
New Hampshire	15,812	20,934	33	25	3	95	.21	.12	.02	.45
Vermont	38,441	55,130	0	526	1	160	0	.95	[4]	.29
Massachusetts	85,018	90,327	1,175	173	51	272	1.38	.19	.06	.30
Rhode Island	15,466	16,780	480	45	7	11	3.10	.27	.04	.06
Connecticut	90,236	78,882	502	261	20	827	.56	.33	.02	1.05
New England	**416,755**	**442,079**	**2,231**	**1,064**	**94**	**1,624**	**.54**	**.24**	**.02**	**.37**
New York	609,445	623,224	16,456	54,240	629	2,822	2.70	8.70	.10	.45
New Jersey	291,008	255,449	23,275	31,314	640	4,534	8.00	12.26	.22	1.77
Pennsylvania	680,947	666,043	21,784	33,104	381	5,672	3.20	4.97	.06	.85
Delaware	94,881	96,013	7,888	3,033	1,274	2,872	8.31	3.16	1.34	2.99
District of Columbia	2,698	4,906	0	41	15	7	0	.84	.56	.14
Maryland	312,543	312,470	14,516	39,879	768	7,722	4.64	12.76	.24	2.47
West Virginia	77,183	76,408	1,745	3,452	14	6	2.26	4.52	.02	.01
Middle Atlantic	**2,068,705**	**2,034,513**	**85,664**	**165,063**	**3,721**	**23,635**	**4.14**	**8.11**	**.18**	**1.16**
Virginia	799,063	796,109	83,037	93,005	431	18,858	10.39	11.68	.05	2.37
North Carolina	1,849,199	1,754,305	18,609	12,245	7,469	64,109	1.01	.70	.40	3.65
South Carolina	941,121	895,158	19,456	17,017	890	37,003	2.07	1.90	.09	4.13
Georgia	1,369,034	1,477,504	54,458	64,522	6,087	44,756	3.98	4.37	.44	3.03
Florida	1,184,681	1,464,708	52,664	244,277	1,406	16,366	4.44	16.68	.12	1.12
South Atlantic	**6,143,098**	**6,387,784**	**228,224**	**431,066**	**16,283**	**181,092**	**3.72**	**6.75**	**.26**	**2.83**
Ohio	1,094,168	1,098,790	32,110	101,927	5,177	34,109	2.93	9.28	.47	3.10
Indiana	1,180,728	1,178,121	75,721	122,355	14,668	108,382	6.41	10.38	1.24	9.20
Illinois	1,506,147	1,596,739	615,478	585,057	34,826	160,924	40.86	36.64	2.31	10.08
Michigan	600,392	735,528	11,013	62,167	1,755	32,699	1.83	8.45	.29	4.44
Wisconsin	441,203	477,852	7,955	40,962	2,287	15,221	1.80	8.57	.52	3.18
East North Central	**4,822,638**	**5,087,030**	**742,277**	**912,468**	**58,713**	**351,335**	**15.39**	**17.94**	**1.22**	**6.91**
Minnesota	322,775	548,517	7,792	83,391	10,233	73,294	2.41	15.20	3.17	13.36
Iowa	652,158	695,519	92,067	214,211	30,557	116,316	14.12	30.80	4.68	16.72
Missouri	756,620	933,202	159,723	315,392	28,436	68,654	21.11	33.80	3.76	7.36
North Dakota	47,677	131,834	20	4,063	50	1,960	.04	3.08	.10	1.49
South Dakota	30,007	38,713	617	7,049	1,540	3,488	2.06	18.21	5.13	9.01
Nebraska	199,116	305,062	10,354	18,983	39,342	159,941	5.20	6.22	19.76	52.43
Kansas	215,889	290,657	7,177	5,241	9,315	35,585	3.32	1.80	4.31	12.24
West North Central	**2,224,242**	**2,943,504**	**277,750**	**648,330**	**119,473**	**459,238**	**12.49**	**22.02**	**5.37**	**15.60**
Kentucky	581,583	596,239	10,692	26,458	1,914	17,535	1.84	4.44	.33	2.94
Tennessee	524,094	601,201	262	2,315	6,669	9,364	.05	.38	1.27	1.56
Alabama	1,183,494	1,079,419	50,276	56,109	2,614	8,577	4.25	5.20	.22	.79
Mississippi	734,728	701,318	22,504	6,647	45,390	56,680	3.06	.95	6.18	8.08
East South Central	**3,023,899**	**2,978,177**	**83,734**	**91,529**	**56,587**	**92,156**	**2.77**	**3.07**	**1.87**	**3.09**
Arkansas	370,677	359,583	388	299	20,538	39,691	.10	.08	5.54	11.04
Louisiana	318,166	291,030	912	3,910	25,343	39,926	.29	1.34	7.96	13.72
Oklahoma	144,990	133,923	12,904	241	1,794	3,868	8.90	.18	1.24	2.89
Texas	560,995	665,376	5,232	55,038	29,188	116,947	.93	8.27	5.20	17.58
West South Central	**1,394,828**	**1,449,912**	**19,436**	**59,488**	**76,863**	**200,432**	**1.39**	**4.10**	**5.51**	**13.82**
Montana	29,102	41,236	256	337	25	3,488	.88	.82	.08	8.46
Idaho	89,994	134,852	7,750	7,320	1,645	36,003	8.61	5.43	1.83	26.70
Wyoming	11,232	15,931	659	194	331	2,435	5.87	1.22	2.95	15.28
Colorado	47,774	89,058	1,912	5,467	6,403	12,590	4.00	6.14	13.40	14.14
New Mexico	22,362	41,111	0	827	2,689	6,694	0	2.01	12.02	16.28
Arizona	155,201	195,979	14,523	13,499	27,100	53,155	9.36	6.89	17.46	27.12
Utah	28,417	37,253	1,166	6,095	1,093	1,995	4.10	16.36	3.85	5.36
Nevada	9,155	5,886	5,761	1,072	256	1,759	62.93	18.21	2.80	29.88
Mountain	**393,237**	**561,306**	**32,027**	**34,811**	**39,542**	**118,119**	**8.14**	**6.20**	**10.06**	**21.04**
Washington	201,271	243,077	629	16,715	20,547	112,763	.31	6.88	10.21	46.39
Oregon	147,400	200,329	834	8,660	3,982	44,770	.56	4.32	2.70	22.35
California	1,525,966	2,589,263	356,922	368,789	169,569	525,713	23.39	14.24	11.11	20.30
Pacific	**1,874,637**	**3,032,669**	**358,385**	**394,164**	**194,098**	**683,246**	**19.12**	**13.00**	**10.35**	**22.53**
Hawaii	140,048	138,129	0	4,464	15,821	49,241	0	3.23	11.30	35.65
Puerto Rico	271,412	257,569	0	0	6,802	8,390	0	0	2.51	3.26
United States	**22,773,499**	**25,312,672**	**1,829,728**	**2,742,447**	**587,997**	**2,168,508**	**8.03**	**10.83**	**2.58**	**8.57**

[1] Includes secondary and trace nutrient materials (borax, gypsum, metallic salts, sulfur etc.) marketed for direct application. Excludes liming materials or the quantities of materials used for manufacture. [2] Total of packaged and non-packaged commercial fertilizers. [3] Includes mixtures, ammonia (anhydrous, aqua), nitrogen solutions, phosphoric acid, potash solutions, phosphoric acid, potash solutions, sulfuric acid, and lime-sulfur solutions. [4] Less than 0.005 percent.



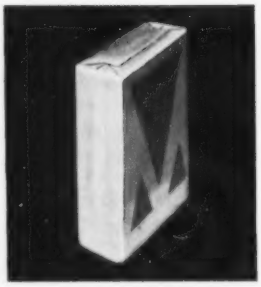
Join the switch to modern, low-cost Capcote PE.

Why use outdated moisture-barrier bags when you can get superior protection at a lower cost with St. Regis® Capcote* PE?

Capcote PE moisture resistance can't be matched. What's more, it provides greater cold-weather strength and pliability, plus increased resistance to acid and alkali. No wonder Capcote PE is the choice of economy-minded packagers throughout the country.

In the last 4 years, the use of PE in fertilizer packaging has nearly tripled, and the big swing came last year with the introduction of Capcote PE. So join the switch from less efficient moisture-barrier sheets to top-quality Capcote PE.

Capcote PE is another example of St. Regis *Packaging-in-Depth*. This complete bag service assures you of the *right* bag, the *right* machinery to pack it, plus the services of skilled engineers. To meet your *future* needs, it includes research to develop improved packaging methods and economies.



*Trademark

PACKAGING-IN-DEPTH BY **St.Regis** BAG DIVISION

In Canada, contact St. Regis Consolidated Packaging Co., Ltd. PAPER COMPANY

Table 2. — Mixtures: Shipments in bulk for retail markets in regions, years ended June 30, 1954 and 1959

Region	Shipments[1]						Percentage of mixture shipments in region shipped in bulk			
	Mixtures[2]		Bulk							
			Solid		Liquid		Solid		Liquid	
	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Percent	1959 Percent	1954 Percent	1959 Percent
New England	351,913	373,619	1,923	917	91	141	0.55	0.24	0.02	0.04
Middle Atlantic	1,837,913	1,815,887	71,240	117,660	229	14,544	3.88	6.48	.01	.80
South Atlantic	5,022,006	5,160,196	168,148	392,022	161	14,535	3.35	7.60	[3]	.28
East North Central	3,621,134	3,632,495	111,201	335,713	1,879	157,478	3.07	9.24	.05	4.34
West North Central	1,343,116	1,552,608	77,124	298,982	412	119,551	5.74	19.26	.03	7.70
East South Central	2,039,846	2,078,604	33,806	63,660	117	11,947	1.66	3.06	.01	.57
West South Central	713,060	691,316	3,608	13,656	1,385	18,880	50	1.98	.19	2.73
Mountain	56,192	73,524	303	6,503	1,035	16,188	.54	8.84	1.84	22.02
Pacific	272,873	412,144	2,070	37,856	22,239	102,964	.76	9.18	8.15	24.98
Hawaii and Puerto Rico	283,023	278,634	0	418	0	7,735	0	.15	0	2.78
United States	**15,541,076**	**16,069,027**	**469,423**	**1,267,387**	**27,548**	**463,963**	**3.02**	**7.89**	**.18**	**2.89**

[1] Includes all quantities of the grade 8-24-0 but excludes 11-48-0, 13-39-0, 16-20-0, 27-14-0, and 21-53-0. [2] Total of packaged and non-packaged commercial mixtures. [3] Less than 0.005 percent.

The quantities of solid bulk shipments in 1959, compared with 1954, were higher in 33 and lower in 17 of the States. There no reports of solid bulk shipments for Puerto Rico. In 1959, solids shipped in bulk ranged from 0.02 percent in Maine to 36.64 percent in Illinois of all fertilizer shipments in the respective States. Tonnages of liquids, however, were substantially higher in all States excepting West Virginia and the District of Columbia. Shipments of liquids ranged from 0.01 percent in West Virginia to 52.43 percent in Nebraska of all fertilizer shipments in these States in 1959. Bulk shipments (solids and liquids) were substantially highest in California, Illinois, Iowa, and Missouri. Their combined tonnages represented 48 percent of the national total of bulk shipments in 1959.

MIXTURES (table 2) shipped in bulk in 1959 accounted for 46 percent of the national total of solid bulk shipments and 21 percent of liquid shipments. In 1954, these proportions were 26 and 5 percent, respectively. In 1959, solid mixtures shipped in bulk ranged from 0.15 percent in Hawaii and Puerto Rico to 19.26 percent in West North Central of all shipments of mixtures in regions. Solid mixtures shipped in bulk in 1959 amounted to 7.89 percent in comparison with 3.02 percent for 1954 of the national consumption of mixtures. In 1959, shipments of liquid mixtures ranged from 0.04 percent in New England to 24.98 percent in the Pacific. The national use of liquid mixtures increased from 0.18 percent (1954) to 2.89 percent (1959) of all mixtures consumed. In the period 1954 to 1959, bulk shipments of mixtures increased in all regions excepting New England.

CHEMICAL NITROGEN MATERIALS (table 3) shipped in bulk in 1959 accounted for 8 percent of the national total of solid bulk shipments and 77 percent of liquid shipments. In 1954, these proportions were 2 and 92 percent, respectively. In 1959, solid chemical nitrogen materials shipped in bulk ranged from none in Hawaii and Puerto Rico to 21.93 percent in the Middle Atlantic of all shipments of these materials in the regions. Solid chemical nitrogen materials shipped in bulk in 1959 amounted to 4.71 percent, compared with 1.09 percent in 1954, of the national consumption in this class. In 1959, shipments of liquids (ammonia, anhydrous, aqua, and nitrogen solutions) for direct application ranged from 11.54 percent in the Middle Atlantic to 59.53 percent in Hawaii and Puerto Rico of this class of materials. The national use of these liquids increased from 16.62 percent (1954) to 37.12 percent (1959) of the total tonnage of chemical nitrogen materials consumed. Bulk shipments of these liquid products were substantially higher in all regions.

PHOSPHATE MATERIALS (table 4) shipped in bulk in 1959 accounted for 31 percent of the national total of solid bulk shipments and one percent of liquid shipments. In 1954, these proportions were 50 and 3 percent, respectively. In 1959, solid phosphate materials shipped in bulk ranged from 0.17 percent in New England to 55.29 percent in East North Central of all shipments of phosphate materials in the regions. Solid phosphate materials shipped in bulk in 1959 amounted to 33.90 percent, compared with 36.24 percent in 1954, of consumption of phosphate materials. The uses of phosphate rock and superphosphates 22% grades and under in 1959 were

Table 3. — Chemical nitrogen materialls: Shipments in bulk for retail markets in regions, years ended June 30, 1954 and 1959

Region	Shipments[1]						Percentage of chemical nitrogen material shipments in region shipped in bulk			
	Chemical nitrogen materials[2]		Bulk							
			Solid		Liquid		Solid		Liquid	
	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Percent	1959 Percent	1954 Percent	1959 Percent
New England	8,537	11,738	15	4	3	1,483	0.18	0.03	0.04	12.63
Middle Atlantic	62,584	78,224	460	17,155	3,492	9,031	.74	21.93	5.58	11.54
South Atlantic	809,056	880,163	1,041	20,583	16,122	166,557	.13	2.34	1.99	18.92
East North Central	273,356	493,407	15,320	92,418	56,834	193,723	5.60	18.73	20.79	39.26
West North Central	355,588	687,155	2,844	43,456	119,061	339,506	.80	6.32	33.48	49.41
East South Central	555,885	581,105	1,074	713	56,470	80,209	.19	.12	10.16	13.80
West South Central	346,117	473,426	58	10,857	75,440	177,427	.02	2.29	21.80	37.48
Mountain	153,800	252,838	3,968	10,223	32,205	88,902	2.58	4.04	20.94	35.16
Pacific	594,072	951,928	10,842	16,461	159,816	561,597	1.82	1.73	26.90	59.00
Hawaii and Puerto Rico	101,408	83,820	0	0	22,623	49,896	0	0	22.31	59.53
United States	**3,260,403**	**4,493,804**	**35,622**	**211,870**	**542,066**	**1,668,331**	**1.09**	**4.71**	**16.62**	**37.12**

[1] Excludes the quantities used for manufacture. [2] Total of packaged and non-packaged chemical nitrogen materials shipped for direct application.

Table 4. — Phosphate materials: Shipments in bulk for retail markets in regions, years ended June 30, 1954 and 1959

Region	Shipments[1]						Percentage of phosphate material shipments in region shipped in bulk			
	Phosphate materials[2]		Bulk							
			Solid		Liquid		Solid		Liquid	
	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Percent	1959 Percent	1954 Percent	1959 Percent
New England	27,267	28,937	253	50	0	0	0.93	0.17	0	0
Middle Atlantic	125,638	84,234	8,378	26,314	0	0	6.67	31.24	0	0
South Atlantic	134,993	104,365	43,911	12,630	0	0	32.53	12.10	0	0
East North Central	760,631	699,408	593,433	386,721	0	0	78.02	55.29	0	0
West North Central	479,780	631,810	194,479	286,502	0	181	40.54	45.35	0	.03
East South Central	356,342	246,584	48,233	22,409	0	0	13.54	9.09	0	0
West South Central	283,300	235,330	14,378	32,882	38	2,269	5.08	13.97	.01	.96
Mountain	141,974	195,888	6,306	11,333	5,561	9,434	4.44	5.78	3.92	4.82
Pacific	222,095	270,116	12,915	72,104	9,647	11,321	5.82	26.69	4.34	4.19
Hawaii and Puerto Rico	12,866	17,085	0	1,313	0	0	0	7.68	0	0
United States	**2,544,886**	**2,513,757**	**922,286**	**852,258**	**15,246**	**23,205**	**36.74**	**33.90**	**.60**	**.92**

[1] Excludes the quantities used for manufacture. Includes all quantities of the grades 11-48-0, 13-39-0, 16-20-0, 27-14-0, and 21-53-0. [2] Total of packaged and non-packaged phosphate materials shipped for direct application.

less than in 1954. As a large percentage of rock and superphosphates are shipped in bulk in areas where principally consumed, the national decrease in bulk shipments of solid phosphate materials reflects this decreased use. Phosphoric acid, which is the only liquid phosphate material, represented less than one percent of the national consumption of phosphate materials. In the Mountain region its use about equaled that of solid bulk phosphates in these years.

POTASH MATERIALS (table 5) shipped in bulk accounted for 5 percent (1959) and 1.5 percent (1954) of the national total of solid bulk shipments. Shipments of potash solutions were insignificant. In 1959, solid potash materials shipped in bulk ranged from 1.89 percent in South Atlantic to 47.05 percent in East North Central of all shipments of potash materials in the regions. Solid potash materials shipped in bulk in 1959 amounted to 26.62 percent, compared with 7.20 percent in 1954, of consumption of potash materials.

OTHER CLASSES OF MATERIALS shipped in bulk were the natural organics and the secondary and trace nutrient materials. In 1954 and 1959, the national consumption of the natural organics amounted to 420,068 tons and 517,948 tons. Of these amuonts, 25,192 tons (6.00 percent) and 9,071 tons (1.75 percent) were shipped in bulk. In both of these years, there was a very small amount of fish solubles sold mostly in bottles. Consumption of all solid secondary and trace nutrient materials for direct application in 1954 and 1959 amounted to 612,416 tons and 1,210,726 tons. Of these amounts, 349,041 tons (56.99 percent) and 270,084 tons (22.31 percent) were shipped in bulk. Liquid shipments were 3,097 tons (1954) and 12,478 tons (1959). Practically all of the secondary and trace nutrient materials shipped in bulk were lime-sulfur solutions, sulfuric acid, and the lower grades of gypsum and sulfur. Ninety-five percent was shipped in the Pacific region and the balance principally in the Mountain region.

This study indicates that the quantity of fertilizer marketed to the retail trade in non-packaged form increased from 2,417,725 tons in 1954 to 4,910,955 tons in 1959. In 1954, non-packaged shipments were made up of solids (76 percent) and liquids (24 percent). In 1959, these proportions were for solids 56 percent and liquids 44 percent. The growth in non-packaged shipments has been principally in liquids. On the other hand, packaged solids amounted to 20,355,774 tons in 1954 and 20,401,717 tons in 1959. Although the quantity of solid packaged fertilizers has changed little, the rate of growth has been much less than that of total fertilizer use.

Presented before the fourteenth annual convention of the Association of American Fertilizer Control Officials, Washington, D. C., October 14, 1960, for their OFFICIAL PUBLICATION NO. 14.

This is only one of the many valuable features appearing in their annual publication. Copies of the complete publication may be obtained at $2.00 each from B. D. Cloaninger, Secretary-Treasurer, P. O. Drawer 392, Clemson, S. C.

Table 5. — Potash materials: Shipments in bulk for retail markets in regions, years ended June 30, 1954 and 1959

Region	Shipments[1]						Percentage of potash material shipments in region shipped in bulk			
	Potash materials[2]		Bulk							
			Solid		Liquid[3]		Solid		Liquid[3]	
	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Tons	1959 Tons	1954 Percent	1959 Percent	1954 Percent	1959 Percent
New England	3,274	2,671	0	93	0	0	0	3.48	0	0
Middle Atlantic	6,603	9,240	1,786	2,633	0	60	27.05	28.50	0	.65
South Atlantic	94,628	90,217	1,013	1,703	0	0	1.07	1.89	0	0
East North Central	123,591	206,660	22,301	97,242	0	134	18.04	47.05	0	.06
West North Central	29,177	51,959	2,190	19,323	0	0	7.50	37.19	0	0
East South Central	67,526	64,019	510	4,747	0	0	.76	7.41	0	0
West South Central	41,760	39,081	269	2,073	0	327	.64	5.30	0	.84
Mountain	1,067	2,826	0	273	0	0	0	9.66	0	0
Pacific	9,634	15,235	95	957	8	10	.99	6.28	.08	.06
Hawaii and Puerto Rico	13,993	13,024	0	2,733	0	0	0	20.98	0	0
United States	**391,253**	**494,932**	**28,164**	**131,777**	**8**	**531**	**7.20**	**26.62**	[4]	**.11**

[1] Excludes the quantities used for manufacture. [2] Total of packaged and non-packaged potash materials shipped for direct application. [3] Less than 0.005 percent.

How Union-Camp's 5-Star Multiwall Plan increased a pallet payload by 400 lbs. . .without increasing its size!

A leading supplier of high density resins* had been packing his product in 50-lb. sewn-bottom multiwalls. This gave him an efficient, 40-bag (2,000 lb.) pallet load.

When he added a *low density* resin to his line, however, he found his existing bag wouldn't accommodate 50 lbs. of the new resin due to its increased volume. A slightly larger, sewn-bottom multiwall was tried, but this reduced the pallet payload to 32 bags (1,600 lbs.). Net "loss": 400 lbs. Net result: more handling . . . more trips to the warehouse . . . higher cost.

Heightening the pallets to 10 tiers instead of 8, offered no solution—they wouldn't pass through the existing archways. To say nothing of the problem of loading trucks and trailer cars.

New bag does the trick

At this point, the 5-Star Packaging Efficiency Plan went to work. Union-Camp multiwall specialists experimented with several different bag sizes and styles. Their solution—a multiwall with a *pasted* bottom and side gussets, a *rectangular*-shaped base—and 20 per cent more capacity!

With the new design, 50 lbs. of the low density resin can now be packed in each bag. Most importantly, the pasted bottom bags can be palletized five to a tier, eight tiers to a skid for a total payload of 2,000 lbs.—the same as the high density resins.

Warehouse space saved

The pasted-bottom bag offered several outstanding advantages. It permitted better use of warehouse space. It increased the yield per warehouseman to *1,000,000 lbs. a month.* And it initiated the development of a similar design for the company's high density resins, which could increase the present pallet payload to 2,500 lbs.

Space-saving secret is in bottom of bag. New design (left) with rectangular-shaped base has 20 per cent more capacity than sewn-bottom bag (right).

Works for you five ways

Apart from bag construction and materials handling, Union-Camp's 5-Star Plan covers bag design, packaging machinery and specifications control. An improvement in any one of these areas conceivably could result in substantial savings for you. In any case, it costs nothing to find out. See your local Union-Camp man for complete details.

2,000 pallet load of new, low density resin bags fits easily through existing doors.

FREE 16-PAGE BOOKLET

Write Dept. M-3 today for a free copy of Union-Camp's new 5-Star Plan booklet. It describes many case histories showing how packers like yourself have achieved greater efficiency and economy in their multiwall operation.

UNION-CAMP*
MULTIWALL BAGS
Union Bag-Camp Paper Corporation 233 Broadway N.Y. 7, N.Y.

* NAME ON REQUEST

new literature about equipment, materials and supplies

Bulk Blending Plants

'Profit-Engineered Bulk Fertilizer Plants' is the name of a four-page, three-color folder describing a new line of bulk blending units offered by Stedman Foundry and Machine Co.

Offered on a 'run-it-yourself' basis where Stedman constructs the plant complete, or a 'do-it-yourself' basis where detailed plans are furnished for the buyer to construct his own plant with local help, the leaflet gives detailed scale drawings of four different units. Described in each case is the equipment included in the 'package.'

Three of the plants are designed for one-man operation at a capacity of 15 or more tons an hour; the fourth design is for two-man operation at a capacity of 30 tons hourly.

Also described in the folder are separate plant components offered by Stedman: mixer, elevators, scales, chain mill, screen, structures, plans, electrical, and pneumatic controls.

For a free copy of Stedman's Catalog 520, circle number 1 on CF's Information Service card, page 51.

New Air Transmitter

The Omega Air Transmitter, Model 86-01, is described in B-I-F Industries new bulletin, Ref. No. 86-20-1. It produces pneumatic pressures proportional to the speed of rotation of a primary unit, solving the problem of changing rotary motion to a linear output air signal. Applications include use with recording instruments, or in control or pacing of feeders. According to B-I-F this Cable Operated Air Transmitter has: **1.** Low speed input—20 rpm produces an air output of 15 psi. **2.** Flexible Cable Drive—unit does not have to be mounted on the machine to pick up the speed input. **3.** Low Torque—free-turning rate wheel offers no resistance — only power required is that necessary to rotate the flexible cable.

For Ref. No. 86-20-1, on the Omega Air Transmitter, Cable Operated, circle number 2 on CF's Information Service card, page 51.

Pulley Puller

A new four-page brochure describes and illustrates a line of 5, 20 and 50-ton hydraulic pulley pullers available from Industrial Engineering Equipment Company.

The units are portable, adjustable for height and spread, and completely eliminate the use of sledge hammers, crowbars and other makeshift methods of removing gears, pulleys, bearings, couplings, etc., from shafts.

A set of new accessories, including a quicklink chain attachment, to hold the puller arms together, and ten ram adapters, for the hydraulic ram, are available with the pullers, as well as to present owners of this equipment.

For further information, circle number 3 on CF's Information Service card, page 51.

Bucket Elevator Components

Publication of a new 24-page components bulletin, No. 6057P, for Rex-Rated Bucket Elevators has been announced by Chain Belt Company. Bulletin 6057P features simplified selection charts and informal aids which allow quick and easy selection of centrifugal and continuous discharge elevator components. It contains basic data on such Rex components as chains, buckets, sprockets, bearings and take-ups.

The component selections outlined by Chain Belt in the bulletin provide a completely inter-related series of balanced units engineered for modern bucket elevator operations. The selection procedures and tables furnished are based on years of Chain Belt experience in elevator component design and application, the best possible answer to maximum service life—greatest wear life—and maximum protection against lost production.

For your free copy of bulletin 6057P, circle number 4 on CF's Information Service card, page 51.

Bag Carry-Handle

A new plastic handle for sewn multiwall bags has been developed by Union Bag-Camp Paper Corporation. The company says laboratory and factory tests indicate that the handle has twice the strength of competitive models.

Manufactured of polyethylene plastic, the handle is sewn to one end of a multiwall bag and lies flat in an inverted position until used. The potential market for this type of handle bag includes all package products in carry-out units of about 25 pounds.

The handle has been designed with extra thickness at the 'shoulder.' This, together with the high-quality polyethylene from which it is manufactured, gives it superior strength. In addition, the handle has been engineered to give it a better 'feel.' The sharp edge, common to most plastic handles, was eliminated by adding thickness across the grip. With a smoother, broader edge in contact with the fingers, greater carrying comfort results.

Union-Camp offers the handles in four standard colors: black, red, yellow and green. Other colors can be manufactured to order.

For further information, circle number 5 on CF's Information Service card, page 51.

Fold-Away Tank

A new descriptive sheet gives specifications on Gates Rubber Company's line of collapsible tanks for transportation of liquid fertilizers and other materials.

The illustrated sheet describes the cover, reinforcement and lining materials, and gives specifications on the shipping weight, length, empty width, and full diameter of six tanks, ranging from 500 to 3250-gallon capacity.

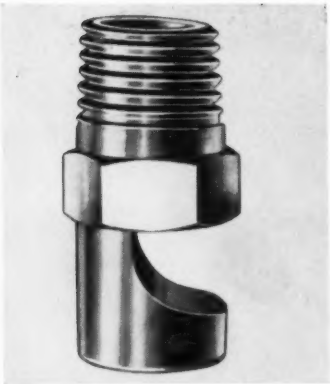
For a copy of Gates sheet MRG-485, circle number 6 on CF's Information Service card, page 51.

Combustion Indicators

Hazegage Combustion Indicators are designed for the job of continuous, accurate and reliable combustion supervision in all sizes and types of heaters. They are serving as smoke indicators as well as a dependable way to maintain maximum combustion efficiency.

Red and green lights are included in the instrument panel board to notify the attendant of combustion conditions instantly and provide the information needed to make whatever adjustments or corrections are necessary. Every change in fuel or air adjustment or malfunctioning of furnace, burners or controls is indicated immediately after it occurs so that there is no observation lag. Therefore a CO_2 sampling is unnecessary. These instruments are applicable for new or existing heaters.

For illustrated literature giving further details, circle number 7 on CF's Information Service card, page 51.



New Flooding Nozzle

A new nozzle called the Type F (flooding) nozzle has been added to the Delavan Manufacturing Company's 1961 line of sprayer equipment.

The new Type F nozzle delivers a deflected, wide fan-type spray and is well suited in the delivery of post-emergence chemicals, defoliation chemicals and even fertilizers. It is available in brass and stainless steel.

For catalog 2-1-10, describing the new nozzles, circle number 8 on CF's Information Service card, page 51.

IR Wavelength Calibrators

Wavelength calibrators for infrared spectrophotometers are being offered at no cost by the Scientific and Process Instruments Division of Beckman Instruments, Inc.

A polystyrene film in one end of the calibrator may be inserted into the sample compartment of most infrared spectrophotometers.

By comparing the spectral curve produced by the film with a polystyrene curve printed on the back of the calibrator, the operator is able to check the instrument for calibration, resolution, and stray light.

The laboratory tool is attractively styled, durable, and easy to use.

For a free calibrator, circle number 9 on CF's Information Service card, page 51.

Tank-Saver Coating

Substantial reduction in maintenance costs of ammonia and acid tanks is promised by makers of Spatz Formula M-146, called Ammonia-Tank Saver.

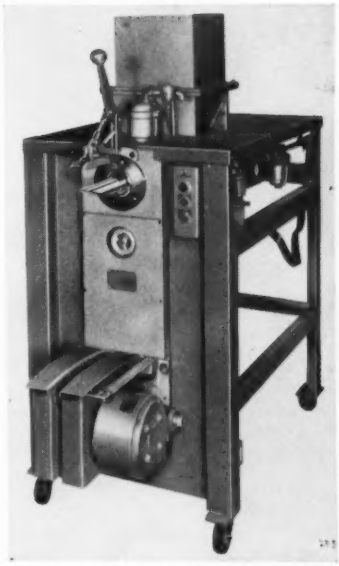
This new coating is compounded to eliminate 'on-the-job-mixing' of two-part paints that are presently being used by the industry. Formula M-146 comes in a single container ready to be applied.

One of the main features of this epoxidized rubber coating is its unusual resistance to the effects of inorganic chemicals such as anhydrous ammonia, hydrochloric, sulphuric and phosphoric acids. Another feature claimed for 'Ammonia-Tank Saver' product is that little, if any, surface preparation is needed prior to application. All one needs to do is brush off loose rust-scale or dirt says the manufacturer, and the coating can be applied to bare metal surfaces or over old paint. It has great hiding power and one coat is usually sufficient, either by roller, brush or spray; Spatz recommends the roller method of application as a means to effect additional savings.

The new product contains ingredients which give it intense blue-white characteristics, to reflect heat and thus substantially reduces excess product loss caused by evaporation. Other ingredients in the Formula M-146 maintain its elasticity. It offers extreme resistance to salt spray and other weather elements. 'Tank Saver' sets and bonds to the surface within three to four hours, dependent on existant climatic conditions. The product does not require thinning. No special primers are needed. One coat gives the surface approximately a 3 mil thick film when applied with a roller; this is three times that of ordinary paint.

Spatz offers special roller equipment, economically packaged, known as the Professional Roller 'Crew Kit.'

A special pamphlet available from Spatz Paint Industries is yours free by circling number 10 on CF's Information Service card, page 51.



Bag Shaker Attachment

Reductions in bag sizes and resultant savings in bag costs are being accomplished with a new bag shaker recently developed by Coddington for use on either their Auger-Matic or Air-Pac valve bag packers.

The accessory, consisting of two shaker arms powered by a small built-in electric motor, causes a reciprocal motion of the arms in contact with the bottom of the bag. This agitation of the bag throughout the entire filling operation causes the material—especially fluffy or coarse materials or other products which do not readily level themselves in the valve bags—to settle quickly into their most compact form, assuring the use of minimum size bags and often bringing about considerable saving in bag costs. Well-filled bags also provide a better appearing package and stack more efficiently for shipment or storage.

Full particulars on this new automatic bag shaker for use on both Auger-Matic and Air-Pac valve bag packers can be obtained by circling number 11 on CF's Information Service card, page 51.

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2-61

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COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

Springless Pull-Type Spreaders

Simonsen Manufacturing Company, has added two new pull-type fertilizer spreader models to its line of fertilizer spreading equipment. These new models have fully equalized axles, said to eliminate the need for springs.

This individual suspension provides equal weight distribution on all wheels at all times, which prevents overloading of any one wheel on rough, uneven fields. The model N-28 has four tires and a capacity of two tons. The model N-48 has eight tires and a capacity of four tons.

Advantages claimed for this type of wheel suspension are longer tire life, adequate flotation for soft fields, and less cutting-in and packing fields.

Both the two and the four ton models are eight feet long, have a spreading width of 50 feet and a rate of spread of 60 pounds per acre on up. Special gearing for higher or lower spreading rates is optional.

The N-28 and the N-48 come equipped with stainless steel at all critical points where corrosion can occur: metering gate and guides, micro-adjusting screw and conveyor apron. Both units can be operated with any tractor, and the fan is powered from the tractor PTO. For full information on the N-28 and N-48 models, circle number 12 on CF's Information Service card, page 51.

Centrifugal Pump Catalog

A new twelve-page selection catalog for users of centrifugal pumps has just been published by Dean Brothers Pumps Inc.

Included in this condensed, easy-to-use circular are charts showing the recommended temperature and pressure ranges for ten classifications of Dean Brothers Pumps — from minus 350 F. to plus 1000 F., and up to 1000 psig. Illustrations, brief descriptions and specifications are shown for each.

A copy of this handy reference booklet may be obtained by circling number 13 on CF's Information Service card, page 51.

New Precision Balance

A new precision balance, Model L Precision Balance, has been introduced by Federal Pacific Electric Co. for rapid precise weighings in the fields of research, production, quality control, and analytical work.

Model L precision balance features a distinctive modernized styling which provides not only better illumination for weighing but also stronger construction.

The new balance, which is of double hook design, fills weighing needs in a range as low as 0-3 mg or as high as 0-50 grams. By means of its counterweighing ability, loads up to 3 times scale value can also be weighed.

Chief advantage is the simplicity and speed of operation. To facilitate

rapid repetitive weighings at any value on the dial, the balance is, for example, equipped with a convenient lock and release lever that permits the beam to be locked at any point regardless of the position of the index pointer. The balance also has an efficient magnetic damping system that insures the beam coming to rest quickly. In addition, there is a vernier index that permits accurate reading to 1/10 scale division.

Accuracy in the new balance is insured within plus or minus 1/10 of 1% by the use of sapphire ring jewels that support the element on the precision ground knife edges. Also provided is a micrometer zero adjustment which enables zero settings to be made before the start of each operation.

Flexibility is provided in the new Model L precision balance by the ability of the instrument to achieve extensional range through counterweighing without any decrease in accuracy. By placing counterweights on the left hook to offset the weight of the pan or accessory on the right hook, the range of the balance can be increased threefold.

13" x 6" x 10" in size, the new balance has a net weight of only 10 lbs. Supplied with each instrument is a newly designed carrying case which allows it to be transferred easily from place to place. The balance will be available in March.

Further information can be obtained by circling number 14 on CF's Information Service card, page 51.

Multi-Bearing Takeup Frames

Link-Belt's new Multi-Bearing takeup frames, available from stock in 11 sizes, are especially designed to accommodate any type of bearing —babbitted, bronze, ball or roller— in any two-bolt pillow block with mounting holes up to 5/8 in.

The new frames allow horizontal bearing adjustments from 6 to 24 in. and will mount 143 different bearing shaft sizes from 5/8 to 2-7/16 in. diameter. Mounting pads are easily adjusted to the mounting holes in the pillow block. One pad is moved by an adjusting screw, while the other pad slides freely to the proper distance between the pillow block mounting holes. This mounting flexibility permits each size of takeup frame to accept a wide range of pillow block bore sizes. Mounting bolts are zinc plated and washers and nuts for mounting the pillow block are furnished with each frame.

The new, all-steel frames have strong channels that form a rugged box frame with high rigidity. Channels also protect the adjusting screw

and provide easy access for lubrication and cleaning. The large diameter adjusting screw is zinc plated for maximum protection against rust. Mounting feet, formed from heavy gauge steel, have two stiffening ribs for added strength and the pillow block mounting pads are of one-piece steel welded construction.

A one-page Leaflet 2821, 'Multi-Bearing Takeup Frames,' contains additional information and is available free by circling number 15 on CF's Information Service card, page 51.

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Commercial Fertilizer and Plant Food Industry

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Bulletin on Crushers

Availability of an illustrated, technical catalog on Young 'Robinson' horizontal saw tooth and vertical cone crushers has been announced by the Robinson Division of Young Machinery Co. Bulletin C-360A provides full design and dimensional data for seven different sizes of saw tooth crushers and three sizes of vertical cone crushers.

In addition to illustrations of various models, the catalog shows close-up photographs revealing saw tooth construction as well as vertical cone grinding elements. Horizontal saw tooth crushers are designed for processing phosphate rock, talc rock, chemicals and many other materials. Vertical cone crushers are primarily used for crushing soft clays, chemical components, corncobs, and similar items. The former equipment accomplishes the crushing operation by means of two assemblies of star-pointed saws rotating toward each other. The cone crusher operates by bringing the product into contact with a spiked and corrugated conical element revolving within a similarly spiked and corrugated conical shell cylinder.

Copies of Bulletin C-360A are available by circling number 16 on CF's Information Service card, page 51.

New Controller Line

Barber-Colman, Wheelco Industrial Instruments Division, has introduced the Double-O, a new line of round chart recording and indicating controllers. Popular and quality features of their Electronic Potentiometer Line have been incorporated into one full-sized recorder-controller line.

Double-O Controllers are completely self-contained, null-balancing instruments requiring only an external sensing device. A wide range of models are available for

the measurement, indication, control and permanent recording of temperatures. With proper circuitry and the use of transducers, such variables as speed, strain, hydrogen ion (pH) and other quantities which can be resolved into electrical signals can be recorded and controlled.

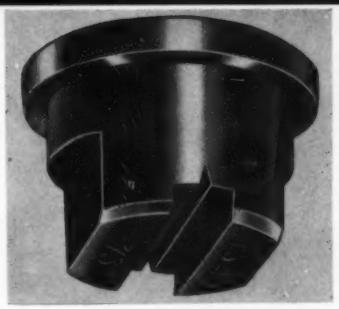
This new line gives ½ to 1% accuracy for all scale spans in pyrometric range. All thermocouple and radiation pyrometer ranges down to 5 MV full scale are available. Full-scale balance speed is 4 seconds . . . full-size 12" chart has calibrated width of 4⅝". Zener diode assures continuous standardization. Built-in Fail-Safe is standard.

For full information, circle Number 17 on CF's Information Service card, page 51.

Nylon Flat Spray Nozzle

A new nylon flat spray nozzle for the application of all agricultural chemicals has been introduced by Delavan Manufacturing Company.

This new tip will be furnished in a range of sizes from 5 GPA to 100 GPA and in 65°, 73°, and 80° spray



angles for different spraying heights.

It is completely corrosion resistant and has better wear characteristics than either brass or aluminum.

For complete information on Nylon FS tips contained in Descriptive Bulletin 2-1-5, circle number 18 on CF's Information Service card, page 51.

High capacity unit for **heavy duty** service

New Truck Applicator, Nurse or Transport

. . . equipped with **positive-displacement metering pump** driven by split-shaft power take off

. . . equipped with **centrifugal pump** for transferring solution

. . . supplied with **1000-gal.** aluminum or coated steel tank

. . . 27½-foot **aluminum** or **stainless steel** pipe booms equipped with shock absorbers

. . . booms **swing** upward and forward against tank sides for travel

. . . spray **tips** and **nozzles** for any application method

. . . roller pump for **agitation** of solutions with herbicides

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liquid and solid fertilizer application equipment

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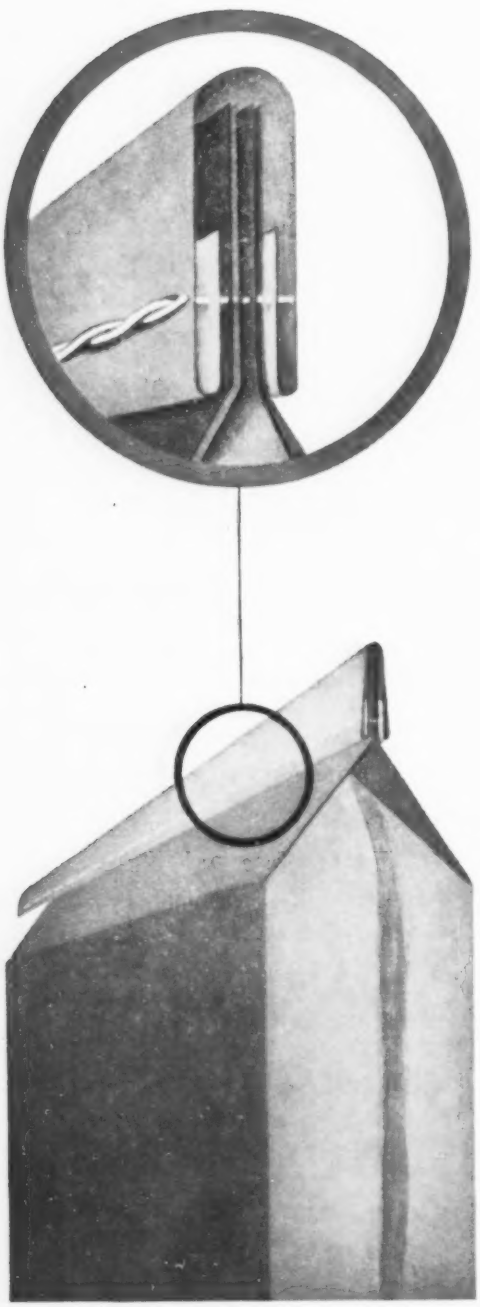
NEW ImpacTAPE™

DRASTICALLY REDUCES SEWN-END BAG FAILURE



Pioneer in the development of Clupak* extensible paper, West Virginia now leads the way to a far stronger, tighter, money-saving sewn multiwall through "ImpacTape."

ImpacTape is a revolutionary new type of sewn tape closure** that adds four layers of tape to the sewn end instead of the conventional two. This provides *49% greater toughness* than standard sewn 70-lb. tape closures plus a new "cushioning" against impact shock.

PROOF from actual field trial

A leading cement company had an unusually high sewn valve breakage rate of 1%. They packed a trial shipment of bags, using West Virginia's new ImpacTape. Average breakage rate went down to .3%—a reduction of 70%. Dollar savings from reduced breakage will far exceed the small upcharge for the new closure.

PROOF from new testing technique

The development of ImpacTape was hastened by West Virginia's successful adoption of the Impact Resistance Tester to measure sewn end toughness under conditions of sudden shock. It represents the only sewn closure test devised thus far which bears a predictable correlation to drop tests and actual field performance.

Studies indicate that 70% of sewn bag breakage ordinarily is at the sewn closure, even on Clupak paper bags, because the sewn closure is the weakest point in the bag. Often this breakage was incorrectly blamed on the paper. Now stronger ImpacTape opens the door to profits from the greater toughness and possible basis weight reductions which Clupak paper is delivering to thousands of users. *This is realistic research achievement —aimed straight at reducing your total packaging costs.*

For a brochure giving detailed information, write and tell us whether you use sewn open mouth or sewn valve bags. Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Ave., New York 17, N. Y.

**Clupak, Inc.'s trademark for extensible paper manufactured under its authority and satisfying its specifications.*

***Patent Pending.*

West Virginia
Pulp and Paper

Research Briefs . . .

Harvest timing seems to have more bearing on phosphorus content than fertilization, is the somewhat startling conclusion reported by Dr. R. E. Blaser of VPI. Says he: forage crops harvested in early May averaged .38 phosphorus, as compared with .36 and .29 for mid and late May cutting.

Fallout cannot be removed from the soil by the harvesting of crops, says USDA. In test plots, dusted with radioactive isotopes, not more than 35% of fall-out was removed, and mostly it was less. Grain harvested two weeks after contamination showed a very low level of radioactivity. Time seems to be the important factor.

Fish growth is directly related to the type of soil over which the stream flows in which they are hatched, New Jersey soil and biology men have found. The nutrient elements that come down-stream become part of the aquatic system, the lakes and rivers become solution cultures. This goes also for water-grown plant life.

Water "mileage" is increased by the use of fertilizer, according to Missouri research. They find that well fertilized corn needs less water than poorly fed corn . . . and well fed crops can reach out for water stored in the soil, according to Dr. E. M. Kroth of the University.

Leaching rains in Mississippi's winter make it more practical to apply N in the spring, rather than in the fall. Plants per acre dropped off as much as 25% on fall feeding as compared to spring, in experiments conducted by Mississippi's AES.

Lime on extremely acid soils probably exerts the greatest single influence on increasing crop yields, says Ohio's AES. The extension services of Michigan State and Purdue concur in this, with the added suggestion that fall application gives the lime more time to sweeten the soil.

Christmas trees stay fresh longer when supplied with plant food, and are readily fireproofed by dunking the base in ammonium phosphate, or by spraying ammonium phosphate. It is a bit early for Christmas ideas, but you might like to think about some specialty products for sale in the fall. The data comes from Florida's AES.

TVA trees will be used strictly to experiment with various applications of fertilizer, with emphasis on the effects of new nitrogen fertilizers. They will produce some 8,690,000 seedlings this year. They will also test for cheaper seed bed mulching materials, and methods of producing hardwoods, such as yellow poplar and red oak.

Poinsettias can have their growth stunted and can be started in May and be right for Christmas — not towering, and with bigger and better decorative red tops—by the use of a chemical which has been nicknamed CCC. For the right name of this growth-regulator, ask Richard S. Lindstrom, horticulturist at Michigan State. Incidentally, this also permits the growing of more plants from cuttings in a season.

Soils, Water, and Fertilizer Basic Research Needed

Basic research to develop new knowledge of the mineral nutrition of plants, behavior of water on agricultural watersheds, and new principles of rangeland soil management was urged by the U. S. Department of Agriculture's Soils, Water, and Fertilizer Research Advisory Committee at its annual meeting, January 3-6 at Weslaco, Texas.

Understanding of the mineral nutrition of plants, particularly the complex processes taking place between roots and soil, is essential for future soil-management studies as well as for national conservation programs, the committee said.

Among projects meriting high-priority attention, the committee decided, is exploration of methods of modifying fertilizer area to reduce its tendency to lose nitrogen when used as a top dressing without benefit of timely rain.

Detailed recommendations for research to be undertaken by USDA will be submitted formally to the Department within the next few weeks. Copies of this report will be available from the committee's executive secretary, Dr. Carleton P. Barnes, Office of the Administrator, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.

U. S. Phosphoric Issued Di-MoN Patent

U. S. 2,963,359 issued December 6, 1960, to G. F. Moore and Thomas Beer, assigned to Tennessee Corporation, describes a process for producing a granular modified diammonium phosphate, 18-46-0, marketed under the trade name Di-MoN.

The patent covers a process which is unique in that the reaction and granulation are accomplished in an unusually simple process flow.

This process flow is well adapted to positive control, which yields a product of excellent physical and chemical uniformity.

Lawns to be Big Factor in 1961 Fertilizer Sales

W. H. Garman, NPFI's chief agronomist recently predicted that fertilizer sales should continue upward for two major reasons:

1) rapid growth of urban expansion

2) more sound information on how to have a good lawn as more fertilizer concerns enter the specialty field and develop more intensive educational and merchandising activity.

To date, he says, non-farm fertilizer still represents only 10% of the total tonnage.

GLF Rounds out Dealer Year with Home and Garden Dept

GLF, the huge cooperative headquartered in Ithaca, New York, has done something about the dealer problem of "dead" months in the year. At the same time they have recognized the growing importance of specialty fertilizers, and the profit which can come from good marketing practices in this field.

This is evident from GLF's move to set up their new and completely separate Home and Garden department, with its own lines of plant foods and home gardening equipment. The department is headed by Edward J. Biggie.

Fertilizer to Raise Jute Production

An official of the Government of India, in a recent statement promising increased yields of mesta, from which jute is made, established the point that more fertilizers would be available as one of several reasons why conditions could improve.

WHAT ARE YOUR FERTILIZER PLANT DESIGN REQUIREMENTS?

Dorr-Oliver has had 45 years' experience in the field of concentrated fertilizer production via the wet process of manufacturing phosphoric acid. Dorr-Oliver designs and builds complete plants.

Let us send an engineer to discuss your requirements.

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Dorr-Oliver designs plants for producing strong acid (32 to 33% P_2O_5) directly by its well-known process.

DIAMMONIUM PHOSPHATE BASED COMPOUNDS

Dorr-Oliver designs plants producing directly from 32 to 40% P_2O_5 phosphoric acid a wide variety of compounds such as 14-14-14, 14-28-14, 12-36-12, 11-48-0, 16-20-0 and 18-46-0 as hard, uniform, free-flowing granules based on mono or diammonium phosphates.

PHOSPHORIC ACID EVAPORATION

Dorr-Oliver designed vacuum evaporator stations eliminate serious scaling, reduce P_2O_5 losses to a negligible point and involve no fume problem.

NON-GRANULAR TRIPLE SUPERPHOSPHATE

Dorr-Oliver designs plants for producing a soft triple superphosphate with optimum characteristics for mixing and ammoniation.

AMMONIUM SULFATE FROM CALCIUM SULPHATE

Dorr-Oliver has successful experience in the use of by-product gypsum from phosphoric acid

MIXING AND GRANULATION

Dorr-Oliver designs plants for producing compounds in the form of hard, uniform, free-flowing granules from a variety of raw materials in solid or liquid form.

TRIPLE SUPERPHOSPHATE FOR DIRECT APPLICATION

Dorr-Oliver designs plants to produce hard, uniform, free-flowing granules by its own process requiring evaporation to only 38% P_2O_5 with no need for subsequent curing.

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Association Activities

Georgia PFES Elects Dozier, Hears 1965 Tonnage Predictions

Georgia Plant Food Educational Society held its annual meeting at Athens January 17. The group elected new officers, changed its organizational set-up, and heard reports on the changing fertilizer picture, including predictions of consumption in the state in 1965.

R. G. Dozier, Jr., of Stevens Industries, Dawson, was elected president, and G. Allen Burson of Cotton Producers Assn., Atlanta was elected vice president. Lee DeYoung of Southern Nitrogen Co., Savannah, was elected secretary-treasurer.

A change in by-laws abandoned the former practice of electing four vice presidents, one for each region in the state, in favor of a single statewide vice president. It also authorized the election of 16 directors from the state at large, rather than four from each district as in the past. Four additional directors consist of the immediate past-president, the dean of the college of agriculture, and the directors of the experiment stations and extension service.

New directors elected at the January meeting are: Ty Griffeth, Cotton States Fertilizer Co., Macon; D. B. Crowley, F. S. Royster Guano Co., Athens; J. H. Boatright, Carr & Boatright, Sandersville; William J. Cook, A. D. Adair & McCarty Bros., Atlanta; Weyman W. Harley, Southern States Fertilizer & Chemical Co., Savannah; W. H. Lariscy, Jr., Screven Oil Mill, Sylvania; W. H. Jordan, Farmers Warehouse, Leary; and J. D. McLeod, Omega Fertilizer Works, Tifton.

Carry-over directors are: W. G. Neuhaus, Armour Agricultural Chemical Co., Augusta; William L. Baughcum, International Minerals & Chemical Corp., East Point; R. H. Woodward, Swift & Co., Atlanta; Quentin S. Lee, Cotton Producers Assn., Atlanta; J. E. Hall, Jr., Soperton Guano Co., Soperton; E. M. Thorne, Millen Fertilizer Co., Millen; Paul Renfroe, Virginia-Carolina Chemcial Corp., Albany; Jack Smith, Smith Guano Co., Moultrie; Dean C. C. Murray, College of Agriculture, Athens; Director George King, Experiment Stations, Athens; Director W. A. Sutton, Extension Service, Athens.

Retiring President J. B. Amos of Etheredge Guano Co., Augusta, also joins the board.

Pursuing the annual meeting's theme, "The Changing Fertilizer Picture," extension, college and USDA specialists predicted increased use of fertilizer in the state on field and horticultural crops, ornamentals and roadsides. Each made specific projections of trends in acreage and fertilizer application rates to paint a picture of sharply increased tonnage sales by 1965.

Four extension specialists outlined the programs the extension service is following through these changes. They brought up-to-date information on the county-by-county intensified soil fertility campaign, and explained the impact of the new 'Big M' pasture program.

How the fertilizer industry should meet the change was the topic of Sam Tisdale, Sulphur Institute agronomist, who urged a positive approach in fertilizer selling, and warned against selling on price alone. He suggested a 10-point educational and promotional program that would make for improved fertilizer sales and better profits for the manufacturer, dealer and farmer.

The annual meeting was concluded with a banquet that evening.

New and old officers of Georgia Plant Food Educational Society (left to right): incoming President R. G. Dozier, Jr., Stevens Industries, Dawson; retiring President J. B. Amos, Etheredge Guano Co., Augusta; new Vice President G. Allen Burson, Cotton Producers Assn., Atlanta; retiring Secretary-Treasurer J. Fielding Reed, American Potash Institute, Atlanta; and incoming Secretary-Treasurer Lee DeYoung, Southern Nitrogen Co., Savannah.

ASSOCIATION BRIEFS

Arizona Fertilizer Conference, scheduled for Feb. 8-9 at the University, Tucson, will emphasize communication between knowledge and the farmer, and two panels on fertilizer research.

Arkansas Plant Food Educational Society, meeting in Little Rock last month, elected as its president Rex L. Morgan, executive vice-president of Ark-Mo Plant Food Co., Walnut Ridge. This was the 10th annual meeting of the society.

California Fertilizer Association has activated a committee to stimulate enrollment in the agricultural courses of California's several four-year colleges. Agriculture is the state's largest industry and needs trained people. Special literature is being prepared.

Colorado soil fertility training sessions were being held last month and part of this at Sterling, Greeley, Fort Morgan and Longmont. They offered a complete short-course in soils and the use of fertilizer.

Florida's Soil and Crop Science Society heard that soil analysis has "come of age." The report read at their meeting said that nearly 100,000 soil samples are being analyzed, mostly free, by 34 laboratories in the state.

Illinois Fertilizer Industry Conference was held February 2 on the campus of the University, with heavy emphasis on soils and their capabilities with or without fertilizers.

Iowa's annual dealer short course supplied a digest of the study showing farm confidence in the dealer, with 950 present. The fertilizer salesman session attracted 300, who were told to "accentuate the positive."

Oklahoma Plant Food Educational Society is giving cash awards to

Association Activities...

FFA chapters winning in FFA Crop Fertilizer Demonstrations.

Western Oregon Fertilizer Conference, held January 31 at Oregon State, heard papers on various specific crops, advertising by dealers, soil testing and turf fertilization.

South Carolina fertilizer manufacturers, dealers and salesmen met in Columbia, some 500 in attendance, to discuss the agricultural picture in papers ranging from the technical to the increasingly important subject of the opportunities in the field for youth.

Minnesota Fertilizer Industry Association elected as president John M. Coates of International Minerals & Chemical.

Texas Fertilizer and Limestone Conference was held last month at Texas A&M, preceded January 9 and 10 by the limestone group in business session. Turf cropped up again, as it does so often now—plus the crop production subjects which are the cornerstone of such meetings.

Washington bankers, meeting in Grandview recently discussed the dollars-per-acre needed to finance farmers in that area. The meeting was based on the wish of a number of bankers for more detailed enlightenment on the fundamentals of the fertilizer and farm chemical industry, in order to make loans more intelligently.

Western Washington Fertilizer Industry Conference is scheduled for February 14 at Chehalis fair grounds. Soil tests and forage production are the major themes.

Empire State Soil Fertility Association, at their first annual meeting at Cornell in December elected as president Joseph Gentle, American Cyanamid, to succeed Robert B. Lenhart, Potash Company of America. Nearly 100 attended the meeting.

Ammonia Institute Elects David Bradford

The 10th annual convention of the Agricultural Ammonia Institute climaxed its January sessions at Memphis, Tenn.; with election of officers and selection of Phoenix, Ariz., as the site of the 1963 convention.

Elected 1961 president of the Institute's board of directors was David H. Bradford Jr., vice president of Mid-South Chemical Corporation, Memphis, Tenn., who succeeds Carl Bauserman of South Michigan Nitrogen Co., Richland, Mich. Mr. Bauserman was named to serve as member of this year's executive committee.

Other officers elected were Robert E. Blobaum, Great Plains Service, Inc., Ashland, Neb., first vice president; Peter G. Arvan, Monsanto Chemical Co., St. Louis, second vice president; Charles M. Corken, Corken's Inc., Oklahoma City, treasurer; and Earl R. Gaffney, Dempster Mill Mfg. Co., Beatrice, Neb., secretary.

Named to serve with Mr. Bauserman as a member of the executive committee was Frank J. Roberson, S&R Gas Co., Soushatta, La.

Phoenix was selected as site of the 1963 convention after the board had considered bids from 29 other metropolitan cities. Next year's sessions will be held in St. Louis, Mo.

GO IMC's DIRECT LINE...

fastest route to superior fertilizer ingredients

Picture this: You're a fertilizer ingredient buyer. Your busy season's ahead. You begin the routine . . . check the list of suppliers, schedule calls, hope for fewest conflicts. The parade begins. One salesman after another — all with products that claim basic specs . . . then your own lab evaluations, shipping dates, inventory control, handling and rehandling. And all the time you hope no one on the *long list* drops the ball. It's worry season for you.

Change the scene: IMC's salesman has the answer — a full line of fertilizer products. And all quality-controlled from mine to you. Want Super? It's on track — coarse, granular, run-of-pile. Potash? Which form — muriate, sulphate . . . sulphate with magnesium? Phosphate rock the way you want it . . . the grade and grind you need. And add phosphoric fertilizer solutions too.

Above all, the consistent, dependable service and quality of IMC products result in superior fertilizer ingredients that add to the effectiveness of your finished formulas . . . their selling appeal on the farm.

Next time it's your "worry season," give the go signal to your IMC salesman. He'll help keep you on track.

Industry Meeting Calendar

DATE	EVENT	LOCATION	CITY
Feb. 16-17	Midwest Industry-Agronomist Meet	Edgewater Beach Hotel	Chicago, Ill.
Mar. 27-28	California Fertilizer Conference	Kellogg-Voorhis Campus	Pomona
June 27-29	Pacific N.W. Fertilizer Conference	Marion Hotel	Salem, Oreg.
July 19-21	Southwest Fertilizer Conference	Galvez Hotel	Galveston, Tex.
Nov. 2-3	Pacific N.W. Fertiilzer Assn.	Gearhart Hotel	Gearhart, Oreg.
Nov. 8-10	Fertilizer Industry 'Round Table'	Mayflower Hotel	Washington, D. C.
Nov. 12-14	California Fertilizer Association	Jack Tar Hotel	San Francisco

Safety Executive Committee to Meet

The average rate of disabling accidents in the fertilizer industry nationally was 22.2 per million man hours in 1959, but for those companies who are members of the Fertilizer Section, National Safety Council, the rate of disabling accidents was 10.6 per million man hours. What can the Fertilizer Section now do to help the industry reduce accidents in fertilizer plants?

On February 9-10, 1961, Ansel Raney of Phillips Chemical Company, section chairman, has called a meeting of the executive committee to be held at the Colonial Inn, St. Petersburg, Fla., to work on this question. Among other things, the committee will place finishing touches on a safety guide for the fertilizer industry. This will be the accumulation of the best ideas on safety in the industry that safety engineers have been able to gather. It will be available to the entire industry when published.

Also slated for discussion is the possible continuance of Supervisory Safety Training Schools, which have been very successful for the past three years under the guidance of W. C. Creel, North Carolina Department of Labor. There is considerable pressure to repeat them in the summer and fall of 1961.

If you are a part of the fertilizer industry, you are welcome to be a member of the Fertiilzer Section, National Safety Council. A card to C. S. Griffith at Virginia-Carolina Chemical Company, Cincinnati, Ohio, will bring prompt action.

Tenant Farmers Fast Disappearing

Tenant farming is fast becoming a thing of the past in the U.S.

At least, this is indicated in preliminary reports from the 1959 Census of Agriculture compiled by the Bureau of the Census and released thus far for 35 States over the country.

In the 35 States, the five-year decrease has been nearly 226,000. Tenant farmers include share croppers who five years ago were dropping out of the farm picture fast.

Tenant farming and share cropping have been disappearing in recent years about as fast as farms themselves and also farm acreage. In the 35 States for which data are available, there are upwards of half a million fewer farms. As for acreage, there are 21.8 million less acres in farming now.

ON TRACK WITH THE ANSWERS TO ONE-SOURCE PRODUCT SUPPLY

- Standard Muriate of Potash
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- Sulphate of Potash
- Granular Muriate of Potash
- SUL-PO-MAG®
- Phosphate Rock, 75/74% BPL Run-of-Mine Unground
- Phosphate Rock, 68/66% BPL Run-of-Mine Unground
- Phosphate Rock, Run-of-Mine Ground
- Triple Superphosphate, Run-of-Pile
- Triple Superphosphate, Coarse
- Triple Superphosphate, Granular
- Phosphatic Fertilizer Solution

FO-4-0T

If you haven't received your complete IMC product sampler — or it has been lost or damaged — ask your IMC salesman for a replacement kit. It's attractively packaged to show your customers the variety of ingredients your finished goods contain.

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ADMINISTRATIVE CENTER, OLD ORCHARD ROAD, SKOKIE, ILLINOIS, YORKTOWN 6-3000

A $60,000,000 STEP IN ARMOUR'S PROGRAM OF PROGRESS

As America's need for more and better fertilizers grows, Armour Agricultural Chemical Company continues to improve its products and expand its facilities. The latest example of Armour's progressive philosophy is its new $60,000,000 program for increasing its nitrogen and phosphate production facilities. By 1962, new installations will approximately TRIPLE Armour's production of these materials. A nitrogen plant will be built near Sheffield, Alabama, and a phosphate plant near Fort Meade, Florida. In addition, facilities for manufacturing mixed fertilizers will be expanded and modernized.

New installations larger facilities and ever-improving technical methods have made Armour the most respected name in the fertilizer industry: a name synonymous with quality and dependability. The Armour Program of Progress is devoted to improving the products and services that have made the Armour "A" a symbol of quality in the fertilizer industry . . . the "BIG A" in agriculture.

31
SALES OFFICES SERVING THE FERTILIZER INDUSTRY

ARMOUR AGRICULTURAL CHEMICAL COMPANY
General Offices, Atlanta, Georgia

The International Scene

As a new decade begins, let's look closely at the World around us

WORLD SHIPPING OF FERTILIZERS

Has developed sharply

W. G. Weston Ltd, British shipping analysts have pointed out that the last five years have seen a substantial growth in the world shiped fertilizer products rose sharply seaborne movement of manufacturer fertiilzer products rose sharply in the 1955-59 period, they report.

In contrast, shipping requirements for crude fertilizers, mainly phosphate rock, have not shown spectacular growth during the same interval.

The world's major importing areas of crude fertilizers—Japan, Great Britain and the six European Common Market countries — in 1955 received 7,557,000 metric tons as compared with 8,314,000 tons in 1959.

Major exporters of manufactured fertilizers, however, increased their shipments from 4,045,000 tons in 1955 to 7,688,000 tons in 1959. Among these are Japan, West Germany, Belgium, The Netherlands, Luxembourg, France and Italy.

BELGIUM

Nitrate production climbs

A major advance in Belgium's nitrate industry in 1960 was recorded by producers returning information to the Central Statistics Office.

This industry, which was not producing more than about 16,000 tons nitrogen content six years ago, has advanced sharply to average over 25,000 tons in 1959, while 1960 figures advanced to over 27,000 tons.

The production of synthetic ammonia and its derivatives, in the first half of 1960, was 163,897 tons, an advance of over 10,000 tons, compared with the first half of 1959. The nitrogen content of fertilizers produced was hiked by 7,000 tons to 147,000 tons. Production of composite fertilizers was up by 20 per cent to 143,855 tons of fertilizer.

BRAZIL

Imports less for 1959

In 1959 Brazil's imports of chemical fertilizers totalled 286,777 tons valued at U. S. $15.5 million. This is considerably lower than in 1958 when imports totalled 426,000 tons valued at U. S. $25.7 million. Leading suppliers were West Germany (calcium nitrate, ammonium sulphate, urea), and the United States (potassium sulphate, potassium chloride, and calcium superphosphates). Other purchases were made from Belgium, East Germany, Chile, Italy, Switzerland and Austria—Rio de Janeiro.

EIRE

Headache fading slowly

Agriculture, Ireland's main source of income, is still its major economic headache. The problem is to increase production, which has been practically static for two decades. Last year an unusually wet and inclement harvest season, with lower-quality grain and potatoes, accentuated the problem.

Some of the steps taken to improve the situation are the establishment of an Agricultural Institute, more credit facilities to permit the use of more fertilizers and a drive toward mechanization on a cooperative basis.

The most hopeful sign is a movement among young farmers to organize Young Farmers' Clubs, where more progressive methods are stressed in lectures and reading.

FINLAND

Fertilizer production up 13%

Production of fertilizers in Finland increased 13 percent in 1959 to 582,000 metric tons. This figure represents net output, eliminating duplication where domestically made materials are used for further production of mixtures. Major products manufactured are superphosphate, "Kotka" phosphate, calcium ammonium nitrate, and mixed fertilizers. The use of mixed fertilizers has grown rapidly during the last 5 years, increasing by 58 percent. In addition to its own production, Finland imports apatite, potash, and ammonium sulfate-nitrate. Under a Finnish-Soviet trade agreement, 150,000 tons of apatite, 50,000 tons of potash, and 2,500 tons of ammonium nitrate are to be purchased from Russia in 1960. Ammonium sulfate-nitrate is imported, principally from Norway and West Germany. Total 1959 consumption of plant foods was 52,660 tons nitrogen, 93,399 tons phosphate, and 63,420 tons potash, representing increases of 17, 11, and 11 percent, respectively, over 1958 consumption.

GREECE

Imports decline as domestic production gains

Greek imports of fertilizers declined 17 percent to 328,566 metric tons in 1959. Nitrogenous materials, ammonium sulfate and ammonium nitrate, accounted for the major share of imports. Italy was the leading source of fertilizer imports in both years.

The United States was the second largest source in 1958, supplying 50,452 tons of ammonium sulfate, 19,144 tons of ammonium nitrate, and 15,582 tons of phosphatic materials in 1958, but dropped to sixth place in 1959.

Importation of fertilizers is almost exclusively in the hands of the Agricultural Bank of Greece, and purchases are usually made through international bids.

Much of the phosphatic fertilizer consumption is produced domestically. Construction of a $42-million nitrogenous fertilizer plant at Ptolemais began in April 1960 and is scheduled for completion in 1963; planned annual production of 70,000 tons N will meet most requirements for nitrogenous fertilizers.

Lignite will be utilized as the raw material. Plans are under way for another nitrogenous fertilizer plant to make ammonium phosphate.

HINDUSTAN

Cheered by proposed purchase

The proposed purchase of Sui gas by India from Pakistan has suddenly cheered up industrial prospects in northwestern Rajasthan. The fertilizer factory at Hanumangarh will be the first to benefit from the deal.

The gas would be cheap as fuel. The Rajasthan Government has already approached the Union Ministry of Fuel and Mines for purchase of the gas till such time as indigenous sources can be tapped.

The pipeline running north and south from Karachi to Sakkur in Pakistan is being extended northwards and will pass within 40 miles of the Indo-Pakistan border. From Hanumangarh the line may be ex-

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International Scene...

tended into Rajasthan and Punjab as required by industrial or power requirements.

INDIA

Abolition of sales tax

Submitted to the Fertiliser Distribution Enquiry Committee is a proposal to abolish the sales tax on fertilizers, supply them at as low a price as possible with adequate credit facilities attached, creation of a central marketing corporation and steps to encourage the use of mixed fertilizers.

Fertilizer makers reassured

In response to the request made by various foreign firms interested in establishing fertilizer factories in collaboration with Indian firms, the government of India is understood to have assured them that no distinction will be made in the matter of price between them and the public sector fertilizer plants.

The right of the new private factories to sell their products in the open market at uncontrolled prices is recognized in principle. On the other hand, it is probable that the pool system—under which all output is sold to the government at carefully worked out prices — will have to continue until the present acute shortage is met.

In that case, the government will offer the same price to private factories as may be paid to government undertakings for a comparable quality and composition of fertilizer produced from comparable raw materials. Phosphatic and other special fertilizers will continue to be sold outside the pool.

Accepts Ford Foundation offer

The Indian Government has accepted the Ford Foundation's offer to bring a chemical expert out to India to examine technical reports on fertiliser plants. The ultimate objects of the visit would be to create interest among U.S. investors in collaborating with Indian industrialists in the establishment of fertiliser plants in the private sector. Government has already earmarked an additional 200,000 tons of fertiliser capacity for the private sector.

ISRAEL

Mostly produces own fertilizer

Use of chemical fertilizers in Israel declined to 144,926 metric tons in 1959 from 163,188 tons in 1958, owing to lower superphosphate consumption. Consumption of ammonium sulfate increased from 61,122 tons in 1958 to 65,350 tons in 1959. Except for 6,000 tons of calcium ammonium nitrate and 450 tons of urea, Israel produced its own fertilizers.

US-Israel mineral agreement

An agreement granting prospecting rights to part of Israel's phosphate deposits to a U.S. company was signed by the Israel Minister of Development, Mr. M. Bentov, during his recent visit to the U.S.

The agreement provides that the company—the name of which has not been released—spend at least £90,000 on prospecting in the next two years. Should the deposits uncovered justify it, the company will invest up to £3m. in erecting a processing plant capable of turning out a minimum of 500,000 tons of phosphates annually.

In addition, the plant is to produce several hundred thousand tons a year of phosphate-based cattle fodder. If such a plant is set up, Israel is to get royalties at the rate of 7½ per cent, and undertakes to construct a railway to the Red Sea port of Eilat once overall output reaches 600,000 tons annually.

JAPAN

Question of price

Japan, negotiating for the sale of 150,000 tons of ammonium sulphate, urea and other chemical fertilizers to China, has run smack into some price competition from Italian exporters.

The Japanese manufacturers, after considering the effect on prospective sales of 800,000 tons of fertilizer to Formosa and South Korea this year, have decided not to cut their prices.

The decision was made, although the question of price was a crucial one in the negotiations.

Representatives of nine Japanese firms reportedly offered to sell ammonium sulphate at some $2.70 per ton more than the Italians were asking. The Italian quotation was on a c. i. f. basis.

KOREA

"Buy American" delays things

The use of ICA funds, $30,000,000 now authorized, was held up, due to need for clarification of the Buy American policy. Reconstruction Attache of the Korean Embassy Deuk Jo Kim said American fertilizer producers cannot deliver $30 million of fertilizer by the end of March, even if all purchased here. Delivery dead-

line is the end of March for farming.

Kim's survey showed only about $12,600,000 worth can be purchased from American producers, while the rest, when purchased here, could be delivered, at least some of it by the end of June and the rest by the end of September. Belated delivery outrules usefulness.

The remainder has to be purchased outside the United States, Kim said. Shipping cost per ton from the United States is estimated at $10. Fertilizer is a major item under ICA purchase, occupying roughly one-fifth of the total aid.

LEBANON

Wants phosphate know-how aid

The Lebanon Chemicals Company, Beirut, holds mining concessions in the Rift Valley known to contain low-grade phosphate deposits. The phosphate occurs in thin, steep-dipping beds. Exploration has indicated that total reserves may be as high as 4,600,000 tons. Markets for the phosphate, if developed, exist in Lebanon and Turkey. Cyprus, where construction of a superphosphate plant is being considered, also is a potential outlet and it is possible that Lebanese phosphates could compete in other Mediterranean markets. The Lebanon Chemicals Company is interested in developing the phosphates and desires participation of private foreign capital and know-how.

MEXICO

Broad N program ready

The Mexican petrochemical industry is ready to carry out a broad program of nitrogen production at several plants in the states of Guanajuato, Vera Cruz and Chihuahua.

The program announced by Petroleos Mexicanos calls for the production of 200 metric tons daily of anhydrous ammonia at its Salamanca plant in central Guanajuato state. Up to 120 tons daily will be available for conversion to urea, ammonium nitrate, ammonium sulphate or ammonium phosphate, for use in the manufacture of fertilizers, explosives or plastics. The remainder will be available for direct use as fertilizer in the form of liquid gas under pressure or in solution. This plant should be in full operation around May, 1961.

The same plant will produce five metric tons daily of sulfur ammonium to serve as the raw material for the production of poly-sulfur ammonium, used for improving exhausted soils.

According to the program, a further 200 metric tons daily of anhydrous ammonia will be produced at the Minatitlan plant in Veracruz state. The whole of this will be available for conversion to urea, ammonium nitrate, ammonium sulphate or ammonium phosphate. A third anhydrous ammonia plant having a 200-metric ton daily capacity is planned for the Chihuahua area, in northern Chihuahua state. It will be constructed when a substantial proportion of the output of the other two installations is finding buyers.

Producing more domestic fertilizers

Although Mexico is still importing large quantities of fertilizers, especially potash, home production of nitrogenous and phosphorus fertilizers is increasing rapidly.

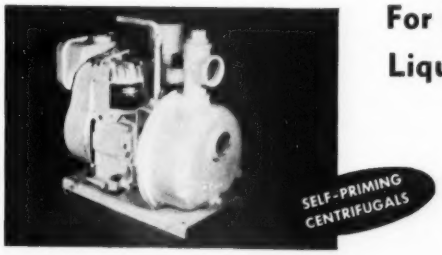
In 1959 the installed capacity for nutrient units of nitrogenous products was 82,955 tons, and phosphorus 18,330 tons. It is hoped that before 1962 these figures will have risen to 188,730 and 54,945 tons respectively, an increase of well over 100 per cent.

During 1961 the important

CROWN MFG. CO.

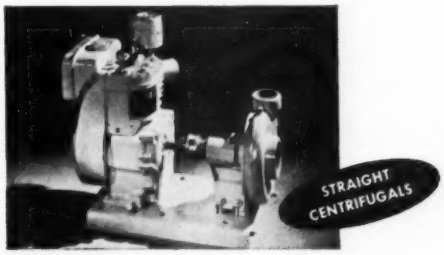
Presents a Complete New Line of

Dependable, Low Cost PUMPS



For Pumping of Liquid Fertilizer

These dependable, ruggedly constructed CROWN pumps are especially designed and engineered to assure you a low cost pump that will deliver under the most demanding conditions. In a Crown pump you get fast action, long life and low maintenance costs.



Check these CROWN PUMP features:

- Stainless Steel Models
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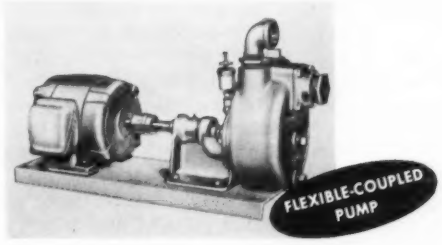

CROWN FIRST . . . newly designed pump that enables you to inexpensively replace the volute and impeller . . . takes only minutes, but saves you many dollars in upkeep. Available in highly resistant NI-RESIST IRON.

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SMART IDEA
For ACID and LIQUID FERTILIZER STORAGE

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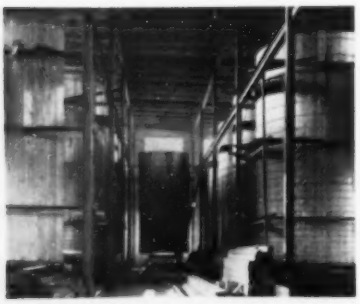

Eleven 23,000-gallon Douglas Fir processing tanks during erection in Iowa processing plant. Easy erection in close quarters.

For many applications such as mixing and storage of chemical solutions, raw materials, waste disposal, etc., nothing has more general utility than Wood, Nature's own corrosion proof material. Wood resists chemical action of practically all solutions within a pH range of 2 to 11, and commonly gives economical service even though slowly attacked by stronger solutions, considering the low original cost.

FOR MORE SEVERE SERVICE . . . GREATER ECONOMY

The introduction of NEW POLYMER LININGS for Wood Tanks has made possible the "POLYCEL" tank — for practically any chemical solution—covering a pH range from zero to fourteen. The combination of a low cost wood membrane and a variety of tough, resistant polymer films offers big advantages over high priced alloys.

Fill out and mail the inquiry form for up-to-the-minute information.

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"POLYCEL" Tanks ☐ Unlined Tanks ☐
Company .....
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Address .....
Description of Chemical Solution .....
Temperature..... Agitation: Yes...No....
Size round tanks inside:
Diameter..... Height.....
Size rectangular tanks inside:
Length..... Width..... Depth.....
Shipped knocked down
or delivered and erected .....

International Scene...

French-Mexican Fertilizantes de Monclova should have its nitric acid and ammonium nitrate plant working to capacity.

Other important Mexican companies are Coque y Derivados S. A., and Guanomex.

Sales of fertilizers to Mexico, which in 1959 amounted to $20.5 million excluding considerable quantities known to have escaped customs vigilance, are made largely through official banks, including agricultural and ejidal credit banks and the National Union of Sugar Producers.

MOROCCO

To spend 50 chemical millions

The Moroccan Government will make initial investment of $50,000,000 in establishing a chemical industry at the Atlantic port of Safi, Morocco's Minister of the National Economy announced.

This will be first major attempt to process mineral resources locally for export. Manufacture of fertilizers would increase this value of phosphate exports fourfold, Economy Minister M'hamed Douiri said.

Morocco exported more than 7,000,000 tons of phosphates, valued at 34,000,000,000 Moroccan francs ($68,000,000) last year. However, the volume of exports dropped for first six months this year because of a reported increase in competition on the world market.

Morocco's State Development Organization will begin the project by setting up a $24,000,000 plant for the production of sulfuric and phosphoric acids.

At the same time, the Moroccan Government has made an agreement with the Royal Dutch-Shell Group for the construction and operation of an $18,000,000 ammonium phosphate plant at Safi. This unit will have a capacity of 110,000 tons a year and is scheduled for completion in three years.

The Government also is studying bids for the awarding of a contract for building and operating a triple superphosphate with a capacity of 200,000 tons a year.

The Economy Minister also announced that parallel decisions had been made by the Moroccan Government for the development of Safi that would involve a new port, railway facilities and a pipeline to bring natural gas north from Mogador.

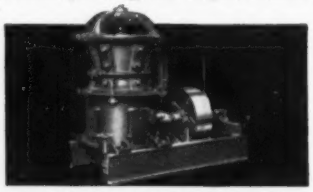
NO MAJOR REPAIRS IN 25 YEARS*

Sturtevant Construction Assures Long Mill Life at Top Loads

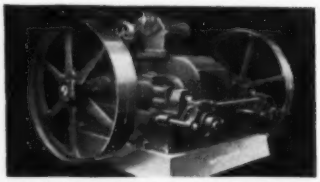
Sturtevant crushing and grinding machinery answers the long life top-load production problem for medium to small size plants. Many Sturtevants have been operating above rated capacities for more than 25 years, and *without a major repair.*

"Open-Door" design gives instant accessibility where needed — makes cleanouts, inspection and maintenance fast and easy. Machines may be set up in units to operate at equal quality and capacity.

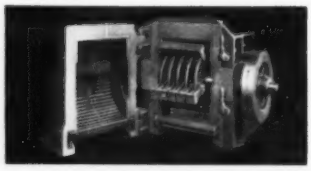
Jaw Crushers — Produce coarse (5 in. largest model) to fine (¼ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

STURTEVANT
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PAKISTAN

Crop yield up 30%

"A thirty percent rise in crop yield can't be ignored in a country where population is increasing at a faster rate than new agricultural production," said Dr. George Vermaat, Dutch soil fertility specialist in Pakistan for the Food and Agriculture Organization.

Since 1957, FAO has been conducting for the Pakistan Government a rapid soil fertility survey allied with a scheme for popularizing the use of fertilizers. Some 2,500 experiments have been carried out in East Pakistan, and some 1,500 in West Pakistan.

"Tests indicate that many paddy soils lack not only nitrogen but also phosphates," Dr. Vermaat said. "We now have some idea of areas where fertilizer application is economic, and can recommend the use of specific fertilizers for particular conditions with some degree of accuracy."

The East Pakistan Government now plans to increase these tests fivefold through a staff of nearly 500 technicians.

POLAND

Developing sulphur deposits

Poland is about to shoulder its way into the world sulphur market with a big multi-million dollar mining and industrial complex built on top of the largest sulphur deposits in Europe.

A crash program has transformed Tarnobrzeg in a little more than two years into a bustling nerve center the most technologically advanced industry in Poland.

RUMANIA

Pushes chemical production

Rumania's industrialization program appears to be making considerable headway in the chemical field, according to reports published in Bucharest.

M. Velea said that in the inorganic sector of the chemical industry, the government last year was able to put into production a nitrogen fertilizer plant at Fargaras, a second soda plant at Govora, a caustic-soda plant and two installations for the manufacture of insecticides at Borzesti.

TANGANYIKA

Big phosphate deposit

A 10-million ton deposit of phosphate was recently discovered in northern Tanganyika, according to the Foreign Agricultural Service. The deposit is near a town called Arusha which is close to roads and railroads. Development plans call for the processing and marketing of about 50,000 tons a year for fertilizer.

VENEZUELA

Big phosphate deposits

Large phosphate deposits have been located by geologists of the Venezuelan Ministry of Mines and Hydrocarbons near the town of Lobatera, Tachira State.

The fertilizer seems to be specially suited for acid soils, because of its heavy content of calcium carbonate. The presence of calcium carbonate makes it particularly useful for coffee plants in sandy soil, which turn yellowish for lack of iron.

The Petrochemical Company of Venezuela plans to build a plant to grind the phosphate into powder. A small plant producing one-ton daily is in operation near the deposits; the phosphate produced there in powder form is given away to farmers who ask for it, in order to get them into the habit of using fertilizers. Test borings are continued, to determine the exact extent of the deposits.

PROFITS GROW BEST

WITH LIQUID FERTILIZER

Liquid fertilizers are booming. In the past two years alone, manufacturing plants have doubled and retailers report sales as high as 100 tons of liquid to every ton of dry!

When you sell liquid fertilizers you offer the farmers in your area greater speed, uniformity, and accuracy of application, lower cost of application per acre, and increased flexibility of application.

Nine chances out of ten your customer will look to you for custom application, too . . . adding further profits on almost every sale.

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No matter what size operation you plan, Tryco can serve you with a more complete line of equipment and supplies than any other company. You'll find Tryco the ideal one-stop source for every need . . . from storage tanks or nurse tanks to transfer pumps, fibreglass tanks, hose, and nozzles.

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Review of Sulphur Industry

The free world's sulphur industry set an impressive list of new records in 1960, according to a year-end statement by Claude O. Stephens, president and chief executive officer of Texas Gulf Sulphur Company, the world's leading producer of sulphur.

According to Mr. Stephens: World production and consumption of sulphur hit new highs; U. S. consumption reached a new peak; U. S. exports topped their previous highs set in 1956; U. S. production of sulphur by the Frasch method climbed again, reversing its three-year trend of declining production; new production records were set in France and Canada.

"By and large, none of these new records represented increases of any great magnitude," Mr. Stephens said, "but in a year generally characterized by faltering production indexes, we are heartened by the performance of the sulphur industry. This trend reinforces our confidence in the long-term growth of the sulphur industry in the 60's," Mr. Stephens said. "We also expect 1961 to be a year which sees a trend toward the firming of prices in world sulphur markets — a trend which began toward the end of 1960."

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TIME TESTED PRODUCTS FOR INDUSTRY

New Alfalfa Movie From Potash Institute

A new motion picture, *Growing Alfalfa Successfully*, has been released by American Potash Institute, featuring special time-lapse photography to show how the plant grows and feeds.

The new 16mm color movie, 25 minutes long, was produced for use by agricultural college personnel, county agents, vo-ag teachers, and other specialists in official agriculture and industry.

Included are the latest management techniques, such as fertilization and liming, seeding, inoculation, cutting, and control of weeds, insects, and diseases.

From the main movie, two shorts have been developed, *Alfalfa Queen of the Forages* and *Good Alfalfa Requires Good Fertility*, which run 10 minutes each and contain the same information as the main movie in two different condensed versions.

The master movie or its condensed version can be booked free of charge by contacting American Potash Institute, 1102 16th St., N. W., Washington 6, D. C., giving a showing date and alternate, as well as name and organization represented.

Obituaries

Edgar Block, 58, senior vice president and general manager of the Chemical Division, Olin Mathieson, died January 4 in Johns Hopkins Hospital, Baltimore.

Dr. Mason H. Campbell, dean-emeritus of the College of Agriculture of the University of Rhode Island, died November 29. He served as dean from 1942 to his 1959 retirement.

George Farrington, president of Phosphate Acidulating Corp., died at his home in Brooklyn, N. Y., December 22.

C. K. Harmison, 55, director of the feed, seed, fertilizer and chemical division of Farmers Union Central Exchange, St. Paul, Minn., died of a heart attack December 21.

August Kochs, 89, founder of Victor Chemical Works, and since the merger a member of the Stauffer board of directors, died in Chicago in November.

classified advertising

RATES: 50 cents a line for **Situations Wanted** ads; $1.00 a line for **Help Wanted** ads; $2.00 a line for all other classified advertising. Word count runs approximately eight words per line. Copy should be received by 15th of month preceding publication. **Display Classified Advertising** $15.00 an inch; minimum space one inch.

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CHEMICAL ENGINEER with fertilizer experience wanted, to conduct bench scale and pilot plant work. Florida location. Box No. 2, % Commercial Fertilizer, 75 Third St. N. W., Atlanta 8, Ga.

RESEARCH SUPERVISOR wanted to head new fertilizer research department. Several years experience in fertilizer production or research and development. Location—seaport city, Middle Atlantic States. Box No. 3, % Commercial Fertilizer, 75 Third St. N. W., Atlanta 8, Ga.

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4 — Davenport #2A dewatering presses
12 — Buflovak 42" x 120" dbl. drum dryers
3 — Shriver 48" C. I. filter presses, 50 ch.
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8 — Allis-Chalmers degerminators

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1 — Sprout-Waldron 24" Burr mill
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1 — Raymond 66" 6-roll mill, rebuilt.
1 — Raymond 50" 5-roller hi-side mill, rebuilt
2 — Hardinge 8'-8" x 70' rot. dryers, 5/8" welded.
2 — Davenport 8' x 60' rot. dryers, 7/16" welded
1 — 7'-6" x 62' rotary cooler, 1/2" welded
2 — Bonnet 7' x 60' rot. dryers, 5/8" shell
2 — Bonnet 6' x 52' rotary dryers, 5/16"
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Edited by VINCENT SAUCHELLI, Chemical Technologist, National Plant Food Institute.

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Among the topics discussed are the factors controlling the preparation of conventional mixed fertilizers, the caking problem, the theory and practice of drying and cooling fertilizers, liquid fertilizers, and corrosion and methods of preventing it in the manufacturing process. Extensive coverage is given to phosphate ore, its mining and processing. In addition, the authors discuss nitrogen compounds, potash salts and granulated fertilizers. The book also includes a detailed description of the processing equipment used in a modern plant.

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CF Staff-Tabulated TONNAGE REPORTS

FERTILIZER TONNAGE REPORT (in equivalent short tons) Compiled by Cooperating State Control Officials and Tabulated by COMMERCIAL FERTILIZER Staff

	December		November		July-Sept. Quarter		January-June		July-December		YEAR (July-June)	
STATE	1960	1959	1960	1959	1960	1959	1960	1959	1959	1958	1959-60	1958-59
Alabama	15,627	18,434	34,799	32,554	79,756	91,258	869,240	846,309	180,959	199,250	1,050,199	1,045,560
Arkansas	5,268	5,376	3,360	3,019	42,604	41,802	303,835	289,363	58,713	63,767	362,548	353,130
Georgia	48,225	49,835	89,908	55,860	131,927	135,678	1,102,220	1,130,998	299,194	294,751	1,401,414	1,425,749
Kentucky	.....	23,262*	9,520	8,985	47,781	49,489	461,786	483,820	108,734	99,460	570,520	591,380
Louisiana	7,177	6,670	11,185	10,816	33,884	25,276	224,087	201,642	66,744	64,152	290,821	265,794
Mississippi	11,028	20,070	16,924	21,902	80,325	75,505	547,221	516,917	142,576	176,371	689,797	693,288
Missouri			31,474	23,877	151,075	147,812	524,336	563,055	277,708	370,036	802,044	933,090
N. Carolina	.....	42,969	37,896	40,883	71,020	60,446	1,381,263	1,468,704	175,533	228,055	1,556,796	1,696,759
Oklahoma	2,966	1,724	6,055	4,606	61,396	45,939	72,246	64,738	72,511	68,848	144,757	133,586
S. Carolina	14,541	22,132	21,541	22,096	46,364	47,443	678,986	756,100	104,903	134,202	783,889	890,302
Tennessee	9,380	10,479	5,581	7,408	83,583	78,916	480,429	443,602	117,275	127,116	607,727	570,718
Texas	24,842	33,196	30,668	31,631	124,709	115,509	474,627	441,851	233,410	222,800	708,037	664,651
California		(reports compiled quarterly)			219,501	204,000	813,116	803,261	465,495	459,735	1,278,611	1,262,996
Virginia		(reports compiled quarterly)			74,530	68,631	591,113	618,965	141,177	160,178	732,290	779,143
Indiana			(reports compiled semi-annually)				828,164	856,316	321,956	316,341	1,150,120	1,172,657
New Hampshire			(reports compiled semi-annually)				14,488	16,143	3,694	4,746	18,182	20,889
TOTAL	139,034	210,885	298,911	263,637	1,248,453	1,187,204	9,367,157	9,513,181	2,770,582	2,989,808	12,147,752	12,499,692

..... (not yet reported) * Omitted from column total to allow comparison with same period of current year.

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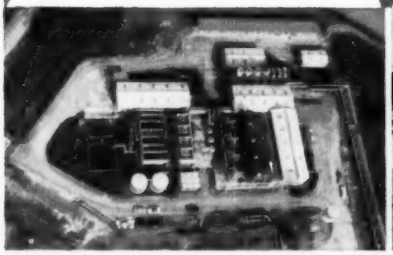

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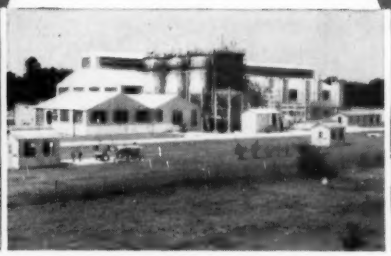

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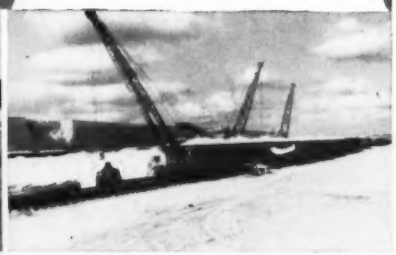

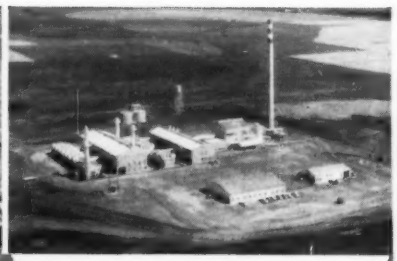

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